Exhibit 1

Notice of Intent to Sue Letter (Feb. 2, 2023) ("NOI Letter I") and Certified Mail Receipts.

February 2, 2023

VIA CERTIFIED MAIL, RETURN RECIEPT REQUESTED

Shell Oil Company
150 North Dairy Ashford Road
Houston, TX 77079
Certified Mail # 70220410000276197675

Shell Polymers Monaca Site
William Watson, General Manager
Kimberly Kaal, Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061
Certified Mail # 70220410000276182930

Re: Notice of Intent to Sue the Owner and Operator of the Shell Polymers Monaca Site in Beaver County, Pennsylvania, for Violations of the Clean Air Act and the Air Pollution Control Act

To the Owners and Operators of the Shell Polymers Monaca Site:

On behalf of Clean Air Council and its individual members, we are writing to provide you with notice that Clean Air Council intends to file a civil lawsuit against you for repeated violations, described below, of the federal Clean Air Act, 42 U.S.C. § 7401 et seq., and the Pennsylvania Air Pollution Control Act, 35 P.S. § 4001 et seq., which occurred and continue to occur at the Shell Polymer Monaca Site in Beaver County, Pennsylvania.

Shell Chemical Appalachia, LLC ("Shell"), a subsidiary of Shell Oil Company, owns and operates the Shell Polymers Monaca Site, located at 300 Frankfort Road, Monaca, Beaver County, Pennsylvania 15061-2210 (the "Plant"). Based on publicly available information, the Plant has repeatedly violated, and is in violation of, the federal Clean Air Act, the Pennsylvania State Implementation Plan, the Pennsylvania Air Pollution Control Act, and Shell's Clean Air Act permit. Shell has emitted air pollutants and visible emissions in amounts in excess of, and not authorized by, the applicable permit and has failed to operate and maintain the Plant according to the application and conditions of the permit.

The citizen suit provision of the Clean Air Act ("CAA") allows Clean Air Council to commence a civil action against Shell in a United States District Court for violations of a Clean Air Act emission standard or limitation. 42 U.S.C. § 7604(a). An emission standard or limitation is defined as any requirement under 42 U.S.C. § 7411 or § 7412, any condition or requirement applicable under a state implementation plan approved by the U.S. Environmental Protection

Agency ("EPA"), any Title V permit, or any requirement to obtain a permit as a condition of operations. 42 U.S.C. § 7604(f).

The citizen suit provision of the Pennsylvania Air Pollution Control Act ("APCA") allows Clean Air Council to commence a civil action against Shell to compel compliance with the APCA "or any rule, regulation, order or plan approval or permit issued pursuant to [the APCA.]" 35 P.S. § 4013.6(c). Clean Air Council may bring an APCA claim in federal court as a supplemental claim to the federal Clean Air Act claim, through supplemental jurisdiction. 28 U.S.C. § 1367(a).

In accordance with 42 U.S.C. § 7604(b), 40 C.F.R. Part 54, and 35 P.S. § 4013.6(d), this letter serves to notify Shell that Clean Air Council intends to file suit for violations of the Clean Air Act and the Air Pollution Control Act in United States District Court for the Western District of Pennsylvania at any time beginning 60 days after the postmarked date of this letter. Additionally, Clean Air Council notifies Shell of its intention to sue for ongoing violations of the same type that occur after the violations outlined in this notice letter.

Clean Air Council will ask the Court to impose appropriate injunctive relief and civil penalties, and require a beneficial environmental project under 42 U.S.C. § 7604(g)(2) in the areas directly impacted by the unauthorized air pollution and emissions from the Plant. Clean Air Council will also ask the Court to award their costs of litigation and attorneys' fees.

The name and address of the party giving notice is:

Clean Air Council
135 South 19th Street, Suite 300
Philadelphia, Pennsylvania 19103

You may contact parties through their counsel at:

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Clean Air Council
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Lotero@cleanair.org (610) 585-1333

APPLICABLE CLEAN AIR ACT AND AIR POLLUTION CONTROL ACT REQUIREMENTS

The Plant is subject to applicable provisions of the Pennsylvania APCA and the Pennsylvania State Implementation Plan ("SIP"), which is a set of state regulations that are approved by EPA, pursuant to the federal Clean Air Act, 42 U.S.C. § 7410.

The Plant is a "stationary source" under the Clean Air Act. Emissions of air pollutants from the Plant are governed by, among other requirements, plan approvals PA-04-00740A, PA-04-00740B, and PA-04-00740C [hereinafter Plan Approvals], issued to Shell by the Pennsylvania Department of Environmental Protection ("DEP") pursuant to 25 Pa. Code Chapter 127 and most recently extended on September 12, 2022. The Plan Approvals contain emission limits, including but not limited to: site-wide, 12-month rolling emission limits; source-specific hourly emission limits; and visible emission limits. Compliance with these permit limits is mandatory and a requirement of the Pennsylvania SIP. 25 Pa. Code § 127.25.

Plan Approval PA-04-00740C, Section C, Condition No. 005, imposes site-wide, 12-month rolling emission limitations of 516.2 tons of volatile organic compounds ("VOCs"). The Plant must comply with this limit at all times. In addition, Plan Approval PA-04-00740C, Section E, Group 02, Condition No. 001 imposes an hourly average NOx emission limit on each turbine/duct burner at the Plant of two (2) parts per million volume, dry ("ppmvd") at 15% oxygen. The limit applies at all times, excluding periods of defined startup or shutdown. For purposes of determining compliance with this NOx limit, Plan Approval PA-04-00740C defines startup "as beginning when fuel is introduced into the turbine and ending when the SCR catalyst bed reaches its design operating temperature" and defines shutdown "as beginning when the SCR catalyst bed drops below its design operating temperature and ending upon removing all fuel from the turbine."

Shell's Plan Approvals and the Clean Air Act also restrict visible emissions from flares and incinerators at the Plant. Plan Approval PA-04-00740C provides that "[v]isible emissions . . . shall not exceed 0% except for a total of five minutes during any consecutive two-hour period" from the following sources: the high-pressure ground flares and emergency elevated flare (PA-04-00740C, Section D, Source 205, Condition #001); the low-pressure incinerator multipoint ground flare (PA-04-00740C, Section D, Source 204, Condition #001); or the spent caustic vent incinerator (PA-04-00740C, Section D, Source 206, Condition #002). Under the Clean Air Act, "flares shall be designed for and operated with no visible emissions . . . except for periods not to exceed a total of 5 minutes during any 2 consecutive hours." 40 C.F.R. § 60.18(b)(1). The Plant must comply with the visible emission limits in the Plan Approvals and Clean Air Act at all times.

Shell's Plan Approvals and the Pennsylvania SIP require proper operation and maintenance of the Plant. Specifically, Plan Approval PA-04-00740C, Section B, Condition No. 004 and 25 Pa. Code § 127.12(a)(10) require Shell to "maintain and operate the sources and associated air cleaning devices in accordance with good engineering practices as described in the plan approval application submitted to the Department." Further, Plan Approval PA-04-00740C, Section B, Condition No. 013 and 25 Pa. Code § 127.25 provide:

> A person may not cause or permit the operation of a source subject to § 127.11 (relating to plan approval requirements), unless the source and air cleaning devices

identified in the application for the plan approval and the plan approval issued to the source, are operated and maintained in accordance with specifications in the application and conditions in the plan approval issued by the Department. A person may not cause or permit the operation of an air contamination source subject to this chapter in a manner inconsistent with good operating practices.

SHELL VIOLATIONS OF THE CLEAN AIR ACT AND AIR POLLUTION CONTROL ACT

The paragraphs below describe Shell's violations of the Clean Air Act and the Pennsylvania Air Pollution Control Act. Shell is a "person" pursuant to the Clean Air Act, 42 U.S.C. § 7602(e), and the Air Pollution Control Act, 35 P.S. § 4003. Because Shell is a person and is the owner and operator of the Plant, Shell is responsible for the violations set forth below. The information presented below is sufficient to enable Shell to ascertain the nature of each alleged violation and when and where it occurred.

1. Violations of Site-Wide, 12-Month Rolling VOC Emission Limitation.

All of the information set forth above is incorporated herein in full. Shell has emitted and continues to emit VOCs from the Plant in excess of limits in Shell's Plan Approvals. Under Plan Approval PA-04-00740C,[1] emissions from the Plant may not exceed 516.2 tons of VOCs in any consecutive 12-month period. The Plant must comply with this limit at all times. Shell emitted 522.982 tons VOCs during the 12-month period ending in September 2022; 666.296 tons VOCs for the 12-month period ending in October 2022; and 739.528 tons VOCs for the 12-month period ending in November 2022. *See* Exhibit A.

The Plant emitted 512.203 tons VOCs during the month of September 2022, alone—nearly reaching the 12-month limit during a single month. Thus, it is almost certain that Shell will continue to violate this VOC limit in each 12-month period until at least September 2023. Each day of each 12-month period with total emissions in excess of the permitted limit for each pollutant constitutes a separate violation of the Plan Approvals and the CAA, for which a penalty of up to $117,468 can be assessed, 42 U.S.C. § 7413(b), 40 C.F.R. 19.4, and the Air Pollution Control Act, for which a penalty of up to $25,000 can be assessed, 35 P.S. § 4009.1(a).

The following table summarizes the violations of 12-month rolling emission limits:

Month	VOC Emissions (tons/month)	VOC Emissions (tons/12-month period)
September 2022	512.203	522.982
October 2022	143.852	666.296
November 2022	74.318	739.528

[1] Plan Approval PA-04-00740A also prohibits VOC emissions that equal or exceed 522 tons in any consecutive 12-month period. Shell also must comply with this limit at all times.

2. Violations of Hourly Average NOx Emissions from the Combustion Turbine/Duct Burners.

All of the information set forth above is incorporated herein in full. Shell emitted NOx from the Plant's combustion turbine/duct burners at rates that exceed limits in Shell's Plan Approvals. The Plant must comply with the hourly average NOx emission limit applicable to the combustion turbine/duct burners, expressed as two (2) parts per million volume, dry (ppmvd) at 15% oxygen (O2), in Plan Approval PA-04-00740C.[2] The limit applies at all times except during periods of defined startup or shutdown. Shell's written reports notifying DEP of these exceedances show that Shell emitted NOx from three combustion turbine/duct burners at rates that exceed that limit on at least four occasions in November 2022 as well as during a period in December 2022. *See* Exhibit B.

Each hour that Shell emitted NOx from the combustion turbine/duct burners in violation of the applicable hourly average NOx emission rate is a separate violation of the Plan Approvals and the CAA, for which a penalty of up to $117,468 can be assessed, 42 U.S.C. § 7413(b), 40 C.F.R. 19.4, and the Air Pollution Control Act, for which a penalty of up to $25,000 can be assessed, 35 P.S. § 4009.1(a).

The following table summarizes the violations of the hourly average NOx emission limit for the combustion turbine/duct burners during November and December 2022:

Source ID	Name	Incident First Observed	Excess Emissions Duration	Emissions Rate (ppmvd @ 15% O2)	NOx Emitted (lbs)	NOx Emitted (tons)
101	Combustion Turbine/ Duct Burner Unit #1	11/7/2022 9:30 am	1 hour	7.240	10.9	0.005
		12/21/2022 12:00 am through 12/28/2022 10:00 am	3 hours	(Not reported)	50.5	0.03
102	Combustion Turbine/ Duct Burner Unit #2	11/5/2022 10:16 pm	1 hour	4.157	16.4	0.008
		11/7/2022 9:30 am	1 hour	6.633		
		11/22/2022 2:45 pm	1 hour	2.753		
		12/21/2022 12:00 am through 12/28/2022 10:00 am	1 hour	(Not reported)	10.4	0.01

[2] Plan Approval PA-04-00740A also includes an hourly average NOx emission limit applicable to the combustion turbine/duct burners, expressed as two (2) parts per million volume, dry (ppmvd) at 15% oxygen (O2). Shell must comply with this limit at all times except during periods of defined startup or shutdown.

103	Combustion Turbine/ Duct Burner Unit #3	11/7/2022 9:30am	1 hour	4.688	20.1	0.024
		11/17/2022 2:57 pm	1 hour	13.987		
		12/21/2022 12:00 am through 12/28/2022 10:00 am	5 hours	(Not reported)	45.7	0.02

3. Violations of Hourly Average CO Emissions from the Combustion Turbine/Duct Burners.

All of the information set forth above is incorporated herein in full. Shell emitted CO from the Plant's combustion turbine/duct burners at rates that exceed limits in Shell's Plan Approvals. The Plant must comply with the hourly average CO emission limit applicable to the combustion turbine/duct burner, expressed as two (2) parts per million volume, dry (ppmvd) at 15% oxygen (O2), in Plan Approval PA-04-00740C.[3] The limit applies at all times except during periods of defined startup or shutdown. Shell's written report notifying DEP of these exceedances shows that Shell emitted CO from three combustion turbine/duct burners at rates that exceed that limit during a period in December 2022. *See* Exhibit C.

Each hour that Shell emitted CO from the combustion turbine/duct burners in violation of the applicable hourly average CO emission rate is a separate violation of the Plan Approvals and the CAA, for which a penalty of up to $117,468 can be assessed, 42 U.S.C. § 7413(b), 40 C.F.R. 19.4, and the Air Pollution Control Act, for which a penalty of up to $25,000 can be assessed, 35 P.S. § 4009.1(a).

The following table summarizes the violations of the hourly average CO emission limit for the combustion turbine/duct burners between December 21st and 28th, 2022:

Source ID	Name	Excess Emissions Duration	CO Emitted (lbs)	CO Emitted (tons)
101	Combustion Turbine/ Duct Burner Unit #1	65 hours	198.8	0.10
102	Combustion Turbine/ Duct Burner Unit #2	50 hours	147.6	0.07
103	Combustion Turbine/ Duct Burner Unit #3	6 hours	41.5	0.02

[3] Plan Approval PA-04-00740A also includes an hourly average CO emission limit applicable to the combustion turbine/duct burners, expressed as two (2) parts per million volume, dry (ppmvd) at 15% oxygen (O2). Shell must comply with this limit at all times except during periods of defined startup or shutdown.

4. Violations of Visible Emissions Prohibition from Flares and Incinerators.

All of the information set forth above is incorporated herein in full. Numerous visible emission events occurred at the Plant in 2022. Shell's Plan Approval PA-04-00740C and the CAA prohibit visible emissions from the Plant's flares and incinerators that exceed 0% opacity for more than five minutes during any consecutive two-hour period.[4] The Plant must comply with these visible emission limits at all times. Shell's written reports to DEP, DEP's inspection reports, and DEP-issued notices of violation show that Shell emitted visible emissions from the Plant's flares and incinerators in violation of Shell's Plan Approvals, the CAA, and the APCA. *See* Exhibit D.

Each two-hour period in which Shell emitted visible emissions from flares or incinerators for more than five minutes in violation of the visible emissions limit is a separate violation of the Plan Approvals and the CAA, for which a penalty of up to $117,468 can be assessed, 42 U.S.C. § 7413(b), 40 C.F.R. 19.4, and the Air Pollution Control Act, for which a penalty of up to $25,000 can be assessed, 35 P.S. § 4009.1(a).

The following table summarizes the violations of the visible emissions requirements per source at the Plant from June to October 2022:

Source	PA-04-00740C Requirement	Date	Duration of Visible Emissions
Multipoint Ground Flare	Section D, Source 204, Condition #001	June 23, 2022	13:35-13:46 (11 minutes)
Elevated/ Emergency Flare	Section D, Source 205, Condition #001	September 8 to 10, 2022	9 minutes during event from 9/8 (23:55) to 9/10 (00:20)[a]
		September 18, 2022	15 minutes during event from 12:03 to 16:41
		September 21-22, 2022	7.5 minutes during event from 9/21 (02:01) to 9/22 (10:15)[a]
		October 24-26, 2022	11 minutes during event from 10/24 (14:30) to 10/26 (16:30)[a]
High Pressure Ground Flares	Section D, Source 205, Condition #001	September 6, 2022	Intermittent from 10:50-12:40
		September 8, 2022	Intermittent during event from 10:22-11:22
		September 13, 2022	7 minutes during event from 11:17 to 12:25

[a] It is our understanding, based on Shell's reports of excess emissions submitted to DEP, that these periods of visible emissions occurred within a two-hour period during these events.

[4] Plan Approval PA-04-00740A also includes prohibits visible emissions from the Plant's flares and incinerators that exceed 0% opacity for more than five minutes during any consecutive two-hour period. Shell must comply with these limits at all times.

CONCLUSION

This notice letter and the attached exhibits are based on publicly available sources of information, including Shell's self-reported malfunction reports. Additional information, including information in the possession of Shell, may reveal additional details about the violations described above and additional violations of the emission limits and Plan Approval conditions described above at the Plant. This letter covers all such violations, including violations of the emission limits and Plan Approval conditions described above that occur after the date of this letter.

If you believe any of the facts described above are in error, have any information indicating that you have not violated the Clean Air Act or the Air Pollution Control Act, or if you have any questions concerning this letter or the described violations, please contact the undersigned attorneys for the Clean Air Council. Finally, we would welcome meeting with you to discuss resolution of this matter prior to the expiration of the 60-day pre-suit notice period.

Sincerely,

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Copies to (by certified mail – return receipt requested):

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Cert. Mail # 70220410000276197620

Shell Polymers Monaca Site
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Kimberly Kaal, Environmental Manager
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Exhibit A

12-Month Rolling Summation Emissions
Shell Polymers Monaca

Year	Month	CO	H2SO4	NH3	Nox	PM (Filt)	PM10	PM2.5	SO2	VOC	CO2	CH4	N2O	Total HAP	CO2e
		Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)	Rolling Emissions (tons/12-mo)
2020	Jan	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Feb	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Mar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Apr	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	May	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Jun	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Jul	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Aug	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Sep	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Oct	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Nov	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Dec	0.842	0.000	0.000	0.636	0.030	0.029	0.027	0.005	0.295	540.43	0.046	0.004	0.001	542.86
2021	Jan	1.104	0.000	0.000	0.844	0.041	0.039	0.037	0.007	0.402	733.52	0.054	0.006	0.003	736.63
2021	Feb	1.309	0.000	0.000	1.016	0.049	0.048	0.045	0.009	0.492	895.58	0.058	0.007	0.004	899.17
2021	Mar	1.514	0.000	0.000	1.188	0.058	0.056	0.052	0.011	0.581	1,058.16	0.061	0.009	0.005	1,062.24
2021	Apr	1.792	0.000	0.000	1.411	0.070	0.067	0.063	0.013	0.695	1,263.68	0.069	0.010	0.007	1,268.45
2021	May	2.029	0.000	0.000	1.600	0.083	0.080	0.071	0.015	0.791	1,437.62	0.076	0.012	0.008	1,442.99
2021	Jun	3.956	0.016	0.000	2.949	0.192	0.243	0.232	0.414	0.960	3,658.76	0.578	0.018	0.011	3,678.57
2021	Jul	5.578	0.016	0.001	4.421	0.314	0.461	0.448	0.417	1.169	7,354.51	1.100	0.026	0.014	7,389.81
2021	Aug	6.157	0.016	0.001	5.070	0.406	0.553	0.537	0.419	1.310	9,392.36	1.578	0.030	0.016	9,440.78
2021	Sep	6.442	0.016	0.058	5.911	0.520	0.796	0.778	0.421	1.423	17,309.82	2.102	0.038	0.035	17,373.65
2021	Oct	6.648	0.016	0.336	6.771	0.815	1.803	1.783	0.424	1.877	39,697.81	2.882	0.070	0.050	39,790.83
2021	Nov	6.624	0.017	0.986	8.235	1.386	3.835	3.814	0.437	2.910	80,516.65	4.005	0.138	0.082	80,657.78
2021	Dec	6.713	0.017	2.797	10.862	2.297	7.067	7.043	0.451	4.579	137,520.57	5.529	0.245	0.132	137,731.74
2022	Jan	6.892	0.018	5.499	13.876	2.458	7.345	7.317	0.464	4.473	187,311.00	7.262	0.340	0.175	187,593.90
2022	Feb	7.129	0.019	7.585	17.245	2.885	8.787	8.753	0.482	4.383	255,590.75	9.356	0.472	0.236	255,965.17
2022	Mar	7.196	0.020	10.253	21.191	3.367	10.444	10.402	0.512	4.296	335,065.99	11.670	0.625	0.307	335,543.96
2022	Apr	7.568	0.021	11.032	22.792	3.563	11.136	11.090	0.522	4.205	368,380.76	13.082	0.688	0.346	368,912.82
2022	May	11.514	0.022	12.201	27.696	3.979	12.615	12.567	0.547	5.280	435,207.48	17.989	0.832	0.455	435,905.18
2022	Jun	17.570	0.007	13.577	34.033	4.398	14.293	14.240	0.179	7.253	509,936.57	26.080	1.019	0.624	510,892.33
2022	Jul	32.170	0.008	15.198	41.943	4.874	16.188	16.128	0.203	9.291	589,394.28	45.050	1.245	0.839	590,891.56
2022	Aug	116.555	0.009	17.685	68.465	5.989	20.442	20.375	0.226	10.993	713,689.62	131.240	1.815	1.613	717,511.53
2022	Sep	533.155	0.011	20.253	224.248	11.562	40.919	40.819	0.282	522.982	1,109,865.18	225.796	4.938	9.296	1,116,981.73
2022	Oct	704.171	0.014	24.282	280.178	14.171	49.402	49.268	0.344	666.296	1,297,966.48	313.270	6.062	14.055	1,307,604.61
2022	Nov	824.897	0.016	27.741	319.778	17.283	56.745	56.580	0.388	739.528	1,435,964.82	412.172	6.849	18.744	1,448,310.09
2022	Dec	824.663	0.015	25.929	317.033	16.367	53.508	53.346	0.373	737.803	1,378,859.50	410.641	6.741	18.694	1,391,134.32

12-Month Monthly Summation Emissions
Shell Polymers Monaca

Year	Month	CO	H2SO4	NH3	Nox	PM (Filt)	PM10	PM2.5	SO2	VOC	CO2	CH4	N2O	Total HAP	CO2e
		Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)
2020	Jan	0.004	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.69	0.001	0.000	0.000	0.707
2020	Feb	0.019	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.92	0.004	0.000	0.000	1.012
2020	Mar	0.020	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.99	0.004	0.000	0.000	1.082
2020	Apr	0.010	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.45	0.002	0.000	0.000	0.49
2020	May	0.004	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.12	0.001	0.000	0.000	0.13
2020	Jun	0.005	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.53	0.001	0.000	0.000	0.56
2020	Jul	0.009	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.62	0.001	0.000	0.000	0.66
2020	Aug	0.011	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.79	0.002	0.000	0.000	0.84
2020	Sep	0.257	0.000	0.000	0.201	0.010	0.010	0.009	0.002	0.101	182.52	0.010	0.001	0.000	183.20
2020	Oct	0.214	0.000	0.000	0.169	0.008	0.008	0.008	0.002	0.085	154.33	0.007	0.001	0.000	154.88
2020	Nov	0.143	0.000	0.000	0.114	0.005	0.005	0.005	0.001	0.053	97.08	0.007	0.001	0.000	97.49
2020	Dec	0.146	0.000	0.000	0.118	0.006	0.005	0.005	0.001	0.055	101.39	0.007	0.001	0.000	101.81
2021	Jan	0.266	0.000	0.000	0.212	0.011	0.010	0.010	0.002	0.107	193.78	0.009	0.002	0.002	194.48
2021	Feb	0.224	0.000	0.000	0.178	0.009	0.009	0.008	0.002	0.090	162.98	0.007	0.001	0.001	163.56
2021	Mar	0.225	0.000	0.000	0.179	0.009	0.009	0.008	0.002	0.090	163.57	0.007	0.001	0.001	164.15
2021	Apr	0.288	0.000	0.000	0.226	0.012	0.012	0.010	0.002	0.114	205.97	0.010	0.002	0.002	206.71
2021	May	0.241	0.000	0.000	0.191	0.013	0.012	0.009	0.002	0.096	174.05	0.008	0.001	0.002	174.67
2021	Jun	1.932	0.016	0.000	1.351	0.109	0.163	0.161	0.400	0.169	2,221.67	0.504	0.006	0.003	2,236.14
2021	Jul	1.631	0.000	0.001	1.476	0.121	0.218	0.216	0.003	0.210	3,696.37	0.523	0.008	0.004	3,711.90
2021	Aug	0.590	0.000	0.000	0.654	0.092	0.092	0.089	0.002	0.141	2,038.64	0.479	0.004	0.001	2,051.81
2021	Sep	0.542	0.000	0.058	1.043	0.124	0.253	0.250	0.003	0.214	8,099.97	0.534	0.009	0.019	8,116.07
2021	Oct	0.420	0.000	0.277	1.029	0.304	1.015	1.013	0.005	0.538	22,542.32	0.787	0.034	0.015	22,572.06
2021	Nov	0.119	0.001	0.650	1.579	0.576	2.037	2.036	0.013	1.086	40,915.92	1.130	0.068	0.032	40,964.44
2021	Dec	0.235	0.001	1.812	2.745	0.917	3.237	3.234	0.015	1.725	57,105.32	1.531	0.108	0.050	57,175.77
2022	Jan	0.445	0.001	2.701	3.226	0.171	0.288	0.284	0.015	0.000	49,984.21	1.743	0.097	0.045	50,056.64
2022	Feb	0.461	0.001	2.087	3.547	0.436	1.450	1.444	0.020	0.000	68,442.73	2.101	0.133	0.062	68,534.82
2022	Mar	0.293	0.001	2.668	4.125	0.491	1.666	1.658	0.031	0.004	79,638.81	2.321	0.155	0.073	79,742.94
2022	Apr	0.659	0.001	0.780	1.828	0.208	0.703	0.698	0.013	0.022	33,520.74	1.421	0.065	0.040	33,575.56
2022	May	4.187	0.001	1.169	5.094	0.429	1.492	1.486	0.027	1.171	67,000.78	4.915	0.146	0.110	67,167.03
2022	Jun	7.988	0.001	1.376	7.688	0.528	1.841	1.833	0.031	2.142	76,950.75	8.594	0.194	0.172	77,223.29
2022	Jul	16.231	0.001	1.622	9.386	0.598	2.113	2.104	0.027	2.247	83,154.08	19.493	0.234	0.219	83,711.13
2022	Aug	84.975	0.001	2.487	27.176	1.207	4.346	4.337	0.026	1.843	126,333.98	86.670	0.574	0.775	128,671.78
2022	Sep	417.141	0.002	2.626	156.826	5.697	20.730	20.694	0.059	512.203	404,275.53	95.089	3.133	7.703	407,586.26
2022	Oct	171.436	0.003	4.306	56.958	2.912	9.498	9.462	0.068	143.852	210,643.62	88.261	1.157	4.775	213,194.94
2022	Nov	120.846	0.002	4.108	41.179	3.689	9.381	9.347	0.057	74.318	178,914.26	100.032	0.855	4.720	181,669.91
2022	Dec	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.00

12-Month Rolling Summation Emissions
Shell Polymers Monaca

Year	Month	CO Rolling Emissions (tons/12-mo)	H2SO4 Rolling Emissions (tons/12-mo)	NH3 Rolling Emissions (tons/12-mo)	Nox Rolling Emissions (tons/12-mo)	PM (Filt) Rolling Emissions (tons/12-mo)	PM10 Rolling Emissions (tons/12-mo)	PM2.5 Rolling Emissions (tons/12-mo)	SO2 Rolling Emissions (tons/12-mo)	VOC Rolling Emissions (tons/12-mo)	CO2 Rolling Emissions (tons/12-mo)	CH4 Rolling Emissions (tons/12-mo)	N2O Rolling Emissions (tons/12-mo)	Total HAP Rolling Emissions (tons/12-mo)	CO2e Rolling Emissions (tons/12-mo)
2020	Jan	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Feb	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Mar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Apr	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	May	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Jun	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Jul	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Aug	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Sep	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Oct	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Nov	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020	Dec	0.842	0.000	0.000	0.636	0.030	0.029	0.027	0.005	0.295	540.43	0.046	0.004	0.001	542.86
2021	Jan	1.104	0.000	0.000	0.844	0.041	0.039	0.037	0.007	0.402	733.52	0.054	0.006	0.003	736.63
2021	Feb	1.309	0.000	0.000	1.016	0.049	0.048	0.045	0.009	0.492	895.58	0.058	0.007	0.004	899.17
2021	Mar	1.514	0.000	0.000	1.188	0.058	0.056	0.052	0.011	0.581	1,058.16	0.061	0.009	0.005	1,062.24
2021	Apr	1.792	0.000	0.000	1.411	0.070	0.067	0.063	0.013	0.695	1,263.68	0.069	0.010	0.007	1,268.45
2021	May	2.029	0.000	0.000	1.600	0.083	0.080	0.071	0.015	0.791	1,437.62	0.076	0.012	0.008	1,442.99
2021	Jun	3.956	0.016	0.000	2.949	0.192	0.243	0.232	0.414	0.960	3,658.76	0.578	0.018	0.011	3,678.57
2021	Jul	5.578	0.016	0.001	4.421	0.314	0.461	0.448	0.417	1.169	7,354.51	1.100	0.026	0.014	7,389.81
2021	Aug	6.157	0.016	0.001	5.070	0.406	0.553	0.537	0.419	1.310	9,392.36	1.578	0.030	0.016	9,440.78
2021	Sep	6.442	0.016	0.058	5.911	0.520	0.796	0.778	0.421	1.423	17,309.82	2.102	0.038	0.035	17,373.65
2021	Oct	6.648	0.016	0.336	6.771	0.815	1.803	1.783	0.424	1.877	39,697.81	2.882	0.070	0.050	39,790.83
2021	Nov	6.624	0.017	0.986	8.235	1.386	3.835	3.814	0.437	2.910	80,516.65	4.005	0.138	0.082	80,657.78
2021	Dec	6.713	0.017	2.797	10.862	2.297	7.067	7.043	0.451	4.579	137,520.57	5.529	0.245	0.132	137,731.74
2022	Jan	6.893	0.018	5.499	13.885	2.458	7.345	7.317	0.464	4.473	187,312.85	7.444	0.340	0.176	187,600.31
2022	Feb	7.130	0.019	7.585	17.256	2.885	8.787	8.753	0.482	4.383	255,593.09	9.629	0.472	0.236	255,974.33
2022	Mar	7.188	0.020	10.258	21.179	3.368	10.446	10.405	0.512	4.296	335,371.98	12.128	0.625	0.307	335,861.48
2022	Apr	7.214	0.021	11.039	22.680	3.571	11.129	11.072	0.522	4.193	368,240.47	13.645	0.688	0.339	368,786.47
2022	May	10.776	0.022	12.211	27.207	3.984	12.580	12.512	0.548	5.257	434,378.43	18.493	0.829	0.426	435,087.68
2022	Jun	16.129	0.007	13.593	32.226	4.400	14.187	14.096	0.186	7.220	508,567.85	25.864	1.002	0.544	509,513.10
2022	Jul	30.176	0.009	15.214	39.348	4.894	16.059	15.939	0.220	9.254	588,247.32	44.343	1.220	0.726	589,719.43
2022	Aug	117.362	0.010	17.802	66.479	6.062	20.391	20.241	0.258	10.961	713,610.57	130.135	1.794	1.482	717,398.43
2022	Sep	552.976	0.012	22.085	228.911	11.826	41.361	41.178	0.308	521.643	1,120,691.55	224.044	4.942	8.716	1,127,765.36
2022	Oct	745.779	0.014	27.429	290.148	14.706	50.706	50.489	0.361	662.948	1,322,352.28	310.848	6.113	13.199	1,331,945.05
2022	Nov	745.660	0.014	26.779	288.569	14.130	48.668	48.453	0.347	661.862	1,281,436.36	309.718	6.045	13.167	1,290,980.61
2022	Dec	745.4251531	0.013308884	24.96778739	285.8247426	13.21331384	45.43103549	45.2191248	0.33245506	660.1375549	1224331.042	308.1874573	5.936627578	13.11720277	1233804.843

12-Month Monthly Summation Emissions
Shell Polymers Monaca

Year	Month	CO	H2SO4	NH3	Nox	PM (Filt)	PM10	PM2.5	SO2	VOC	CO2	CH4	N2O	Total HAP	CO2e
		Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)	Monthly Emissions (tons/mo)
2020	Jan	0.004	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.69	0.001	0.000	0.000	0.707
2020	Feb	0.019	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.92	0.004	0.000	0.000	1.012
2020	Mar	0.020	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.99	0.004	0.000	0.000	1.08
2020	Apr	0.010	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.45	0.002	0.000	0.000	0.49
2020	May	0.004	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.12	0.001	0.000	0.000	0.13
2020	Jun	0.005	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.53	0.001	0.000	0.000	0.56
2020	Jul	0.009	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.62	0.001	0.000	0.000	0.66
2020	Aug	0.011	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.79	0.002	0.000	0.000	0.84
2020	Sep	0.257	0.000	0.000	0.201	0.010	0.010	0.009	0.002	0.101	182.52	0.010	0.001	0.000	183.20
2020	Oct	0.214	0.000	0.000	0.169	0.008	0.008	0.008	0.002	0.085	154.33	0.007	0.001	0.000	154.88
2020	Nov	0.143	0.000	0.000	0.114	0.005	0.005	0.005	0.001	0.053	97.08	0.007	0.001	0.000	97.49
2020	Dec	0.146	0.000	0.000	0.118	0.006	0.005	0.005	0.001	0.055	101.39	0.007	0.001	0.000	101.81
2021	Jan	0.266	0.000	0.000	0.212	0.011	0.010	0.010	0.002	0.107	193.78	0.009	0.002	0.002	194.48
2021	Feb	0.224	0.000	0.000	0.178	0.009	0.009	0.008	0.002	0.090	162.98	0.007	0.001	0.001	163.56
2021	Mar	0.225	0.000	0.000	0.179	0.009	0.009	0.008	0.002	0.090	163.57	0.007	0.001	0.001	164.15
2021	Apr	0.288	0.000	0.000	0.226	0.012	0.012	0.010	0.002	0.114	205.97	0.010	0.002	0.002	206.71
2021	May	0.241	0.000	0.000	0.191	0.013	0.012	0.009	0.002	0.096	174.05	0.008	0.001	0.002	174.67
2021	Jun	1.932	0.016	0.000	1.351	0.109	0.163	0.161	0.400	0.169	2,221.67	0.504	0.006	0.003	2,236.14
2021	Jul	1.631	0.000	0.001	1.476	0.121	0.218	0.216	0.003	0.210	3,696.37	0.523	0.008	0.004	3,711.90
2021	Aug	0.590	0.000	0.000	0.654	0.092	0.092	0.089	0.002	0.141	2,038.64	0.479	0.004	0.001	2,051.81
2021	Sep	0.542	0.000	0.058	1.043	0.124	0.253	0.250	0.003	0.214	8,099.97	0.534	0.009	0.019	8,116.07
2021	Oct	0.420	0.000	0.277	1.029	0.304	1.015	1.013	0.005	0.538	22,542.32	0.787	0.034	0.015	22,572.06
2021	Nov	0.119	0.001	0.650	1.579	0.576	2.037	2.036	0.013	1.086	40,915.92	1.130	0.068	0.032	40,964.44
2021	Dec	0.235	0.001	1.812	2.745	0.917	3.237	3.234	0.015	1.725	57,105.32	1.531	0.108	0.050	57,175.77
2022	Jan	0.446	0.001	2.701	3.235	0.172	0.288	0.284	0.015	0.000	49,986.06	1.925	0.097	0.045	50,063.05
2022	Feb	0.462	0.001	2.087	3.549	0.436	1.450	1.444	0.020	0.000	68,443.23	2.191	0.133	0.062	68,537.57
2022	Mar	0.283	0.001	2.673	4.102	0.492	1.668	1.660	0.032	0.003	79,942.46	2.506	0.155	0.073	80,051.30
2022	Apr	0.314	0.001	0.781	1.727	0.214	0.694	0.677	0.013	0.011	33,074.46	1.527	0.064	0.033	33,131.70
2022	May	3.802	0.001	1.173	4.718	0.426	1.463	1.448	0.027	1.159	66,312.01	4.856	0.142	0.089	66,475.88
2022	Jun	7.285	0.002	1.382	6.370	0.525	1.770	1.745	0.038	2.132	76,411.08	7.874	0.180	0.120	76,661.56
2022	Jul	15.678	0.001	1.621	8.598	0.616	2.090	2.060	0.036	2.244	83,375.84	19.002	0.226	0.186	83,918.23
2022	Aug	87.775	0.002	2.589	27.785	1.260	4.424	4.390	0.040	1.849	127,401.90	86.272	0.578	0.758	129,730.80
2022	Sep	436.156	0.002	4.341	163.475	5.888	21.223	21.187	0.053	510.895	415,180.95	94.443	3.158	7.253	418,483.00
2022	Oct	193.223	0.002	5.621	62.265	3.184	10.359	10.324	0.058	141.843	224,203.05	87.591	1.204	4.499	226,751.74
2022	Nov	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.00
2022	Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

December 14, 2022

SUBMISSION OF EMISSION EXCEEDANCE REPORT AND MITIGATION PLAN

VIA EMAIL: Kimberly.Kaal@shell.com

Kimberly Kaal, Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

Re: PA-04-00740C
Shell Petrochemicals Facility
12-month Rolling Emissions Exceedances and Increased Emissions
Potter Township
Beaver County

Dear Kimberly Kaal,

On November 7, 2022, Shell Chemical Appalachia LLC ("Shell") provided emissions data, including 12-month rolling emission totals for the Shell Petrochemicals Complex. A review of this emissions data identified violations of 25 Pa. Code § 127.25 and the requirements of PA-04-00740C, Section C, Condition No. 005. Specifically, Shell exceeded the 12-month rolling emission totals for VOC in September and October 2022. A Notice of Violation was sent to your attention on December 13, 2022. The emission data also showed increases in emissions of other air contaminants, including carbon monoxide, oxides of nitrogen, and hazardous air pollutants. Shell has represented to the Department that these emission increases are attributable to events occurring during the Commissioning process of the Monaca, Pennsylvania Shell Petrochemical facility.

Per the requirements of PA-04-00740C, Section D, Source ID 204, Condition No. 018, and PA-04-00740C, Section D, Source ID 205, Condition No. 011, Shell is already required to "conduct a root cause analysis within 45 days after any startup flaring event, shutdown flaring event, or unforeseen flaring event" as defined in the conditions. Additionally, per PA-04-00740C, Section D, Source ID 205, Condition No. 010, Shell is already required to "minimize flaring resulting from startups, shutdowns, and unforeseeable events by operating at all times in accordance with an approved flare minimization plan" as detailed in the condition.

The Department requests that within **forty-five (45) days** of your receipt of this letter, Shell submit a technical report ("Emission Exceedance Report and Mitigation Plan") to the Department, which evaluates the Commissioning process for the Facility; the required "root cause analyses" as defined, and confirmation that the Source ID 205 flare has been operated in

accordance with the approved "flare minimization plan." In addition, the Emission Exceedance Report and Mitigation Plan should identify the causes of the excess emissions, sources where the excess emissions occurred, projections of emission exceedances that are anticipated to occur in the future, measures that were employed and measures that could have been employed to have reduced or prevented excess emissions, and a description of and schedule for implementing additional emission mitigating measures. Please include any data, calculations, and references relied upon to prepare the Emission Exceedance Report and Mitigation Plan. The Emission Exceedance Report and Mitigation Plan should encompass the requirements of Section D, Source ID 204, Condition No. 018 and PA-04-00740C, Section D, Source ID 205, Condition No. 010 and No. 011 and expand on them as described in this paragraph. Please submit the report to Anna Hensel, District Supervisor, Department of Environmental Protection, Air Quality Program, at ahensel@pa.gov.

The Department also requests that within **fifteen (15) days** of receipt of this letter, Shell inform the Department if it will provide the Emission Exceedance Report and Mitigation Plan as requested above. Please provide the notification to Anna Hensel, District Supervisor, at Department of Environmental Protection, Air Quality Program, ahensel@pa.gov.

This request for Emission Exceedance Report and Mitigation Plan is neither an order nor any other final action of the Department of Environmental Protection. It neither imposes nor waives any enforcement action available to the Department under any of its statutes. If the Department determines that enforcement action is appropriate, you will be notified of such action.

If you have any questions regarding this request for the Emission Exceedance Report and Mitigation Plan you may contact me at 412-442-4150.

Sincerely,

Mark R. Gorog, P.E.
Environmental Program Manager
Air Quality

cc: Operations – E. Speicher
District Supervisor – A. Hensel
Compliance – K. Goddard
SW OCC – M. Heilman
SW ARD – K. Halloran
Central Office (via email)
Enforcement File: 04-00740

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

NOTICE OF VIOLATION

December 14, 2022

VIA EMAIL: Kimberly.Kaal@shell.com

Kimberly Kaal, Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

Re: PA-04-00740C
Shell Petrochemicals facility
12-month Rolling Emissions Exceedances
Potter Township
Beaver County

Dear Kimberly Kaal:

The Shell Chemical Appalachia LLC ("Shell") Petrochemicals facility is authorized to be constructed and for temporary operation pursuant to plan approvals PA-04-00740A, PA-04-00740B, and PA-04-00740C most recently extended September 15, 2022. On November 7, 2022, Shell provided to the Department emissions data, including 12-month rolling emission totals. Following review of this data, the Department of Environmental Protection (DEP) has noted the following violations:

> Section C, Condition #005 of PA-04-00740C imposes 12-month rolling total emission limitations of 516.2 tons of Volatile Organic Compounds (VOC). The 12-month rolling emissions data provided by Shell shows that for the 12-month period ending in September of 2022 total VOC emissions reached 521.6 tons and for the 12-month period ending in October of 2022 total VOC emissions reached 662.9 tons. By exceeding the 12-month rolling emissions totals for VOC, Shell violated Section C, Condition #005 of PA-04-00740C and 25 Pa. Code § 127.25. Each 12-month period with total emissions in excess of the applicable limitation for each pollutant set forth in Section C, Condition #005 constitutes a separate violation.

The above violation(s) constitute unlawful conduct and a public nuisance as defined by Sections 8 and 13 of the Air Pollution Control Act (APCA), 35 P.S. Sections 4008 and 4013, respectively. Violations of DEP's permits and Air Quality regulations are subject to the penalties of Sections 9 and 9.1 of the APCA.

This Notice of Violation is neither an order nor any other final action of DEP. It neither imposes nor waives any enforcement action available to DEP under any of its statutes. If DEP determines that an enforcement action is appropriate, you will be notified of the action.

If you have any questions concerning this matter, please contact me at mgorog@pa.gov or at 412.442.4150.

Sincerely,

Mark R. Gorog, P.E.
Environmental Program Manager
Air Quality

cc: Operations – E. Speicher
District Supervisor – A. Hensel
Compliance – K. Goddard
SW ARD – K. Halloran
SW OCC – M. Heilman
Central Office (via email)
Enforcement File: 04-00740

Exhibit B

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

January 23, 2023

Mark Gorog P.E., Regional Manager
Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source IDs 101, 102, 103 Combustion Turbine/Duct Burner Units #1, #2, #3 NOx and CO Emissions Malfunction Report, December 21 - 28, 2022

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this incident report to the Pennsylvania Department of Environmental Protection (PADEP).

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  Beginning on December 21 at 12:00AM and continuing intermittently through December 28 at 10:00AM the Combustion Turbines/Duct Burners (Cogen) Units #1, #2, and #3 experienced elevated CO emissions (above 2 ppmvd @ 15% O2). The direct cause of elevated CO emissions is under investigation but correlates with abnormally low ambient temperatures. The majority of sustained elevated CO emissions was between December 23 and December 26 when ambient temperatures ranged between 1 °F and 20 °F as recorded by the on site meteorological station.

  CEMS analyzers were validated with calibration gas direct to analyzer and through the sample system during the event and found no faults. Previous diagnostic testing of the Cogen CO emissions upstream of the CO catalyst had determined the Units to be operating within design specifications. However, testing was not able to be performed upstream of the CO catalyst while also experiencing elevated CO emissions at the stack (above 2 ppmvd @ 15% O2). Shell intends to contract temporary CEMS to be operated upstream of the CO catalyst during the next predicted low temperature conditions in order to evaluate direct combustion turbine and duct burner CO emissions and engage with turbine and duct burner manufacturer's for long term corrective actions.

  On December 23 at ~1:15PM the Combustion Turbine/Duct Burner (Cogen) Unit #3 SCR Heater A tripped offline and initiated a switch to SCR Heater B. This caused a

temporary interruption to ammonia injection while SCR Heater B increased temperature to its design setpoint. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the heater was switched and ammonia injection restored.

Cause of the trip was determined to be freezing due to a sudden ambient temperature drop down to ~2 °F at the time of trip. SCR Heater A was restored at 5:00PM on the same day and has operated successfully since this time. Sitewide winterization procedures and techniques are under evaluation for improvements.

On December 24 at ~11:38AM the Cogen Unit #2 lost boiler feed water and tripped offline. A hot restart was initiated at ~2:07PM. This was considered an abnormal startup due to the circumstances of the trip and restart. Following the startup sequence recommended by Amec Foster Wheeler, the Unit was restarted slowly and maintained at a lower load for a longer period of time than a normal restart. A Unit under low load operates in lean-lean primary firing mode for a more stable operating condition. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the restart procedure was followed, Unit load increased, and the combustion turbine was able to be placed into low-NOx premix steady state firing.

Cause of the loss of boiler feedwater was sustained abnormally low temperatures, and cause of operation in low load lean-lean primary firing was following the manufacturer recommendations for a stable startup. Operations followed startup procedures and were able to return to full load operation by ~3:25PM. Sitewide winterization procedures and techniques are under evaluation for improvements to Unit stability.

On December 24 at ~5:50AM the Cogen Unit #1 lost boiler feed water and tripped offline. A cold restart was initiated on December 25 at ~7:50AM. This was considered an abnormal startup due to the circumstances of the trip and restart. Following the startup sequence recommended by Amec Foster Wheeler, the Unit was restarted slowly and maintained at a lower load for a longer period of time than a normal restart. A Unit under low load operates in lean-lean primary firing mode for a more stable operating condition. Additionally, the ammonia vaporizer experienced temperature fluctuations and instability during the restart. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the restart procedure was followed, Unit load increased, the combustion turbine was able to be placed into low-NOx premix steady state firing, and ammonia vaporizer temperatures were stabilized.

Cause of the loss of boiler feedwater and ammonia vaporizer temperature instability was sustained abnormally low temperatures, and cause of operation in low load lean-lean primary firing was following the manufacturer recommendations for a stable startup. Operations followed startup procedures and were able to return to full load operation by ~11:00AM. Operations took manual control of the ammonia system to balance ammonia injection against the vaporizer outlet temperature to maintain operation and not trip the SCR. Sitewide winterization procedures and techniques are under evaluation for improvements to Unit stability.

- **Time when the incident was first observed, and duration of excess emissions**
  December 21 at 12:00AM through December 28 at 10:00AM

Source ID	Name	NOx Duration (hrs)	CO Duration (hrs)
101	Combustion Turbine/Duct Burner Unit #1	3	65
102	Combustion Turbine/Duct Burner Unit #2	1	50
103	Combustion Turbine/Duct Burner Unit #3	5	6

- **Estimated rate of excess emissions[a]**

Source ID	Name	NOx (lbs)	NOx (tons)	CO (lbs)	CO (tons)
101	Combustion Turbine/Duct Burner Unit #1	50.5	0.03	198.8	0.10
102	Combustion Turbine/Duct Burner Unit #2	10.4	0.01	147.6	0.07
103	Combustion Turbine/Duct Burner Unit #3	45.7	0.02	41.5	0.02
Total		106.6	0.05	387.9	0.19

[a] Mass emissions in excess of 2 ppmvd @ 15% O2 applicable limit

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

December 7, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source IDs 101, 102, 103 Combustion Turbine/Duct Burner Units #1, #2, #3 NOx Emissions Malfunction Report, November 5, 7, 17, 22, 2022

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP).

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  On November 5 at ~10:16PM the Combustion Turbine/Duct Burner (Cogen) Unit #2 SCR Heater A tripped offline and initiated a switch to SCR Heater B. This caused a temporary interruption to ammonia injection while SCR Heater B increased temperature to its design setpoint. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the heater was switched and ammonia injection restored.

  Cause of the trip was determined to be a local stop in the field. However no personnel were found in the area at the time of the local stop. The SCR heater has operated successfully since this time. The SCR will be monitored for potential repeat occurrence and awareness of operational requirements increased.

  On November 7 at ~9:30AM all Cogen Units experienced a sudden drop in natural gas fuel pressure. This resulted in a drop of load for all combustion turbines and tripping off all duct burners. The drop in load triggered the turbines to switch from dry low-NOx steady-state premix to lean-lean firing mode. The switch in firing mode activated as-designed to bring the turbine to a more stable operating condition under low load. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the natural gas pressure was restored, turbine load increased, and firing mode switched back to steady state premix for low NOx.

Cause of the natural gas fuel pressure drop was due to insufficient valve isolation while instrumentation and engineering technicians were working on the natural gas fuel knockout drum closed limit. Corrective action included restoring the valve to the closed position, manual proving of the isolation valves, and increased awareness to verify isolation before performing work.

On November 17 at ~ 2:57PM while restarting Cogen Unit #3 after a maintenance outage, the SCR dilution air flow signal suddenly decreased. This caused a trip of the ammonia injection system due to insufficient air. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while Cogen Unit #3 was shut down again, muffler insulation was removed from interfering with the air flow element, and the unit was then restarted.

Cause of the low air flow signal was air blower muffler material breaking off and interfering with the flow element. Corrective action included removal of the interfering material and restarting of the unit. All blower mufflers have been replaced.

On November 22 at ~ 2:45PM duct burners on Cogen Unit #2 were restarted after an outage. This caused an increase in total NOx emissions in the exhaust of the Cogen Unit #2. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while Operations increased ammonia flow in the SCR control system to adjust to the elevated NOx.

Cause of the elevated NOx was the activation of duct burners and slow response of the ammonia control system to keep up with the control demands. Corrective action included Operations taking manual control to add sufficient additional ammonia to the system, and increased awareness to controlled activation of the duct burners.

- **Time when the incident was first observed, and duration of excess emissions**

November 5, 2022 at ~ 10:16 PM
Unit #2 1 hour (4.157 ppmvd @15% O2)
November 7, 2022 at ~ 9:30AM
Unit #1 1 hour (7.240 ppmvd @15% O2)
Unit #2 1 hour (6.633 ppmvd @15% O2)
Unit #3 1 hour (4.688 ppmvd @15% O2)
November 17, 2022 at ~ 2:57 PM
Unit #3 1 hour (13.987 ppmvd @ 15% O2)
November 22, 2022 at ~ 2:45PM
Unit #2 1 hour (2.753 ppmvd @15% O2)

- **Estimated rate of excess emissions[a]**

Source ID	Name	NOx (lbs)	NOx (tons)
101	Combustion Turbine/Duct Burner Unit #1	10.9	0.005
102	Combustion Turbine/Duct Burner Unit #2	16.4	0.008
103	Combustion Turbine/Duct Burner Unit #3	20.1	0.010
Total		47.4	0.024

a Emissions in excess of 2 ppmvd @ 15% O2 applicable limit

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Exhibit C

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

January 23, 2023

Mark Gorog P.E., Regional Manager
Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source IDs 101, 102, 103 Combustion Turbine/Duct Burner Units #1, #2, #3 NOx and CO Emissions Malfunction Report, December 21 - 28, 2022

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this incident report to the Pennsylvania Department of Environmental Protection (PADEP).

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  Beginning on December 21 at 12:00AM and continuing intermittently through December 28 at 10:00AM the Combustion Turbines/Duct Burners (Cogen) Units #1, #2, and #3 experienced elevated CO emissions (above 2 ppmvd @ 15% O2). The direct cause of elevated CO emissions is under investigation but correlates with abnormally low ambient temperatures. The majority of sustained elevated CO emissions was between December 23 and December 26 when ambient temperatures ranged between 1 °F and 20 °F as recorded by the on site meteorological station.

  CEMS analyzers were validated with calibration gas direct to analyzer and through the sample system during the event and found no faults. Previous diagnostic testing of the Cogen CO emissions upstream of the CO catalyst had determined the Units to be operating within design specifications. However, testing was not able to be performed upstream of the CO catalyst while also experiencing elevated CO emissions at the stack (above 2 ppmvd @ 15% O2). Shell intends to contract temporary CEMS to be operated upstream of the CO catalyst during the next predicted low temperature conditions in order to evaluate direct combustion turbine and duct burner CO emissions and engage with turbine and duct burner manufacturer's for long term corrective actions.

  On December 23 at ~1:15PM the Combustion Turbine/Duct Burner (Cogen) Unit #3 SCR Heater A tripped offline and initiated a switch to SCR Heater B. This caused a

temporary interruption to ammonia injection while SCR Heater B increased temperature to its design setpoint. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the heater was switched and ammonia injection restored.

Cause of the trip was determined to be freezing due to a sudden ambient temperature drop down to ~2 °F at the time of trip. SCR Heater A was restored at 5:00PM on the same day and has operated successfully since this time. Sitewide winterization procedures and techniques are under evaluation for improvements.

On December 24 at ~11:38AM the Cogen Unit #2 lost boiler feed water and tripped offline. A hot restart was initiated at ~2:07PM. This was considered an abnormal startup due to the circumstances of the trip and restart. Following the startup sequence recommended by Amec Foster Wheeler, the Unit was restarted slowly and maintained at a lower load for a longer period of time than a normal restart. A Unit under low load operates in lean-lean primary firing mode for a more stable operating condition. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the restart procedure was followed, Unit load increased, and the combustion turbine was able to be placed into low-NOx premix steady state firing.

Cause of the loss of boiler feedwater was sustained abnormally low temperatures, and cause of operation in low load lean-lean primary firing was following the manufacturer recommendations for a stable startup. Operations followed startup procedures and were able to return to full load operation by ~3:25PM. Sitewide winterization procedures and techniques are under evaluation for improvements to Unit stability.

On December 24 at ~5:50AM the Cogen Unit #1 lost boiler feed water and tripped offline. A cold restart was initiated on December 25 at ~7:50AM. This was considered an abnormal startup due to the circumstances of the trip and restart. Following the startup sequence recommended by Amec Foster Wheeler, the Unit was restarted slowly and maintained at a lower load for a longer period of time than a normal restart. A Unit under low load operates in lean-lean primary firing mode for a more stable operating condition. Additionally, the ammonia vaporizer experienced temperature fluctuations and instability during the restart. This resulted in elevated NOx emissions (above 2 ppmvd @ 15% O2) while the restart procedure was followed, Unit load increased, the combustion turbine was able to be placed into low-NOx premix steady state firing, and ammonia vaporizer temperatures were stabilized.

Cause of the loss of boiler feedwater and ammonia vaporizer temperature instability was sustained abnormally low temperatures, and cause of operation in low load lean-lean primary firing was following the manufacturer recommendations for a stable startup. Operations followed startup procedures and were able to return to full load operation by ~11:00AM. Operations took manual control of the ammonia system to balance ammonia injection against the vaporizer outlet temperature to maintain operation and not trip the SCR. Sitewide winterization procedures and techniques are under evaluation for improvements to Unit stability.

- **Time when the incident was first observed, and duration of excess emissions**
  December 21 at 12:00AM through December 28 at 10:00AM

Source ID	Name	NOx Duration (hrs)	CO Duration (hrs)
101	Combustion Turbine/Duct Burner Unit #1	3	65
102	Combustion Turbine/Duct Burner Unit #2	1	50
103	Combustion Turbine/Duct Burner Unit #3	5	6

- **Estimated rate of excess emissions[a]**

Source ID	Name	NOx (lbs)	NOx (tons)	CO (lbs)	CO (tons)
101	Combustion Turbine/Duct Burner Unit #1	50.5	0.03	198.8	0.10
102	Combustion Turbine/Duct Burner Unit #2	10.4	0.01	147.6	0.07
103	Combustion Turbine/Duct Burner Unit #3	45.7	0.02	41.5	0.02
Total		106.6	0.05	387.9	0.19

[a] Mass emissions in excess of 2 ppmvd @ 15% O2 applicable limit

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Exhibit D

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

October 7, 2022

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740A & C Source IDs 201 Ethylene Manufacturing Line and 205 High Pressure (HP) Header System Excess Emissions Malfunction Report– Ethylene Refrigeration Compressor Trip / V-19031 Inlet Flange Leak

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this malfunction report to the Pennsylvania Department of Environmental Protection (PADEP) for an Ethylene Refrigeration Compressor (ERC) trip and vapor leak that developed on the ethane cracking unit (ECU) cold flare drum (V-19031) inlet nozzle flange that occurred starting on September 8, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  On September 8, 2022 at approximately 23:55 Shell was bringing feed into the C2 Splitter for the first time per the start-up and commissioning procedures. Start-up of the C2 splitter was progressing when the Ethylene Refrigeration Compressor (ERC) tripped on a high dew point temperature setting (144KS370) in this unit. The unit safety systems worked as designed, the automatic isolations worked correctly, and the unit was isolated. Operations took immediate actions to depressurize equipment including the discharge of the Cracked Gas Compressor and to route the process hydrocarbons to the HP Header System. Due to the sudden nature of the trip, some hydrocarbons went to the HP Elevated Flare (HPEF) for several minutes to control the resulting emissions. Related to the automatic shutdown, extremely cold hydrocarbon liquid and vapor entered the cold flare drum (V-19031) in the ECU unit under the process conditions for first time. That same night, Operations noted ice forming on the inlet flange of the cold flare drum during visual inspection of lines indicating a small hydrocarbon vapor leak had occurred. A leak review meeting was held per policy, and it was determined to be safe to attempt a direct repair of the flange leak by increasing torque on the flange bolts above the original installed values for this flange at installation. Scaffold was required to be erected to access the overhead flange and attempt the repair.

  The cause of the original ERC trip was due to an elevated dew point reading experienced during the initial start-up of the unit meant to protect other downstream

process units. Start-up procedures were reviewed by Operations to avoid future trips.

Once a cause was determined for the cold drum inlet flange leak and a solution was identified to prevent further leakage at the cold drum inlet flange; maintenance erected scaffold and executed the increased torque recommendations to tighten the flange bolts further which was successful in stopping the leak. Operating furnaces at the time automatically turned down feed rates to minimize emissions during this event. The HP flares worked as designed to control resulting emissions from isolating and depressurizing the unit.

- **Time when the incident was first observed, and duration of excess emissions**
  The trip occurred on September 8, 2022 beginning at approximately 23:55 and the related flange leak on the vessel inlet nozzle was repaired by 00:20 on September 10, 2022. The ECU was restarted upon repair of the flange leak.

- **Estimated rate of excess emissions**
  - The incident resulted in use of the HPEF for approximately 9 minutes Direct Method 22 observations were not performed at night. Flare camera the duration of HPEF use and resulting visible emissions.

  - Estimated direct emissions from flange leak as calculated with the leak estimation tool for a line leak, estimation method 1:
    - VOC: 0.11 tons
    - HAP (1,3 Butadiene): 0.002 tons
    - CH4: 0.01 tons
    - CO2e: 0.31 tons
  - Preliminary estimated excess emissions flared at the HP flares until the ERC was restarted after the flange was repaired. Note, this estimate does not account for emissions associated with ECU repeated start-up steps to get back to the original ECU start-up progression:
    - VOC: 33.74 tons
    - HAP: 0.32 tons
    - NOx: 11.80 tons
    - CO: 49.09 tons
    - PM10: 1.29 tons
    - PM2.5: 1.29 tons
    - CO2e: 21,782 tons

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

October 18, 2022

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740A & C Source IDs 201 Ethylene Manufacturing Line and 205 High Pressure (HP) Header System Excess Emissions Malfunction Report – Propane Refrigeration Compressor Trip on Low Suction Pressure

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) relating to excess emissions to the HP Flares following a low suction pressure trip of the Propane Refrigeration Compressor (PRC) on September 18, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

  On September 18, 2022, Shell experienced a trip of the Propane Refrigeration Compressor (PRC) at approximately 12:03 that paused the start-up of the ECU. Feed was going into the ECU in accordance with the start-up procedures. The PRC tripped on low 1st stage suction pressure and resulted in feed going to the High Pressure (HP) Flare system including the HP Elevated Flare. During these commissioning, operations was experiencing oscillating vessel level readings which was causing the level controllers to work against each other in vessels V-11434 and V11431. These fluctuations eventually caused swings in the PRC stage 1 suction drum pressure which caused the trip on low pressure.

  The PRC was inspected after the trip and no defects were found. Inspection of the individual level controllers, pressure controllers and controller logic were performed finding no anomalies. Based on these inspections, the controller gain for the PCR stage 1 pressure controller was adjusted to dampen pressure swings. It is expected that this will improve overall control of the system and help reduce the potential for low suction pressure trips in the future.

- **Time when the incident was first observed, and duration of excess emissions**

  The incident occurred on September 18, 2022, beginning at 12:03 and concluded when the unit was ready to restart later that afternoon at approximately 16:41, lasting approximately 4.65 hours.

Emissions were reduced by quickly trouble shooting the cause of the PRC unit trip, making necessary adjustments to the pressure control equipment, and maintaining furnace feed at minimal levels to proceed with restarting the units when ready. Since restarting the PCR in September, the pressure controller adjustments have resulted in improved operation of this unit.

- **Estimated rate of excess emissions**
  - The incident resulted in use of the HP elevated flare for approximately 15 minutes with visible emissions from the HP elevated flare noted for much of that time as determined when reviewing the flare video footage. Method 22 observations were conducted shortly after the flare event occurred. No additional visible emissions were noted during these Method 22 observations.

  - The following emissions are the preliminary estimated excess emissions flared at the HP Flares during this event until the restart of the PRC. Note this estimate does not account for emissions associated with ECU repeated start-up steps to get back to the original ECU start-up progression. Emission estimates are based on the HP header vent gas flow meter readings and gas chromatograph composition data at the time:

    - VOC: 4.59 tons
    - HAP: 0.04 tons
    - NOx: 1.51 tons
    - CO: 6.34 tons
    - SO2: 0.0 tons
    - PM10/2.5: 0.17 tons
    - CO2e: 2817.7 tons

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

October 21, 2022

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740A & C Source IDs 201 Ethylene Manufacturing Line and 205 High Pressure (HP) Header System Excess Emissions Malfunction Report – Acetylene Reactor Unit Trip

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) relating to excess emissions to the HP Flares following a level transmitter trip of the Acetylene (AC) Reactor on September 21, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

  On September 21, 2022 during commissioning activities, Shell experienced a trip of the AC Reactor at approximately 02:01 that paused the start-up of the ECU. Feed was going into the ECU in accordance with start-up procedures. Prior to the trip of the AC Reactor, operations noted the AC Reactor outlet temperature increasing as well as the methanol cooling system drum pressure. Operations took appropriate actions to reduce the AC Reactor's inlet temperature to maintain/decrease the temperature of the reactor's methanol cooling bath. The process design uses a nitrogen gas and ejector system to maintain the methanol cooling system pressure at a steady level to control and maintain safe temperatures in the AC Reactor. At approximately 02:01 the reactor tripped on "fail state" readings when the methanol drum level transmitters read high methanol levels in the drum. The safety shutdown system applies 2 out of 3 voting as part of the safety shutdown system logic. The trip of the AC Reactor resulted in feed being sent to the HP Header System to be controlled at the HP Ground Flares and HP Elevated Flare.

  While the unit's methanol cooling safety controls shut down the AC Reactor as designed, the operational issues noted before the malfunction were reviewed to find a cause and to make any necessary changes. After troubleshooting the malfunction and operational conditions leading up to the trip, it was determined that the likely cause of the pressure swings in the methanol system were due to unsteady amounts of non-condensable gases in the methanol drum vapor space. Operating adjustments were made to the nitrogen ejector system to allow for more steady operation of the methanol cooling system for the AC Reactor.

Time when the incident was first observed, and duration of excess emissions

The incident occurred on September 21, 2022, beginning at 02:01 and concluded when the unit was ready to restart the evening of September 22, 2022 at 10:15, lasting approximately 32.23 hours.

Emissions were reduced by quickly trouble shooting the cause of the AC Reactor trip and operational issues with the methanol cooling system, making necessary adjustments to the pressure control system, and maintaining furnace feed at minimal levels to proceed with restarting the units when ready. Since implementing the corrective actions, operations have restarted the AC Reactor successfully without significant further control oscillations.

Estimated rate of excess emissions

- The incident resulted in use of the HP elevated flare for approximately 8 minutes with visible emissions noted from the high-pressure elevated flare for approximately 7.5 minutes upon review of the flare video footage. Method 22 observations were not attempted due to the short duration of the flaring event and that it occurred at night.

- The following emissions are the preliminary estimated excess emissions flared at the HP Flares during this event until the restart of the AC Reactor. Note this estimate does not account for emissions associated with ECU repeated start-up steps to get back to the original ECU start-up progression. Emission estimates are based on the HP header vent gas flow meter readings and gas chromatograph composition data at the time:

    - VOC: 31.14 tons
    - HAP: 0.27 tons
    - NOx: 9.94 tons
    - CO: 41.26 tons
    - SO2: 0.0 tons
    - PM10/2.5: 1.09 tons
    - CO2e: 18,380.3 tons

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

November 25, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740A/C Ethylene Manufacturing Line (Source ID 201) and High-Pressure Header System (Source ID C205) Excess Emission Report - Initial Ethane Dryer Swap Event (10/24/2022)

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for an unexpected process upset of during the initial swap of two ethane dryers in the Ethylene Manufacturing Line (ECU).

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

  During start-up activities of Ethylene Manufacturing Line (Source 201), Shell operations received a high moisture alarm in the ECU. Because of this, Operations switched from one ethane dryer to a second ethane dryer in order to clear the alarm. This was the first time that the second dryer was put into service. Initial indications were that the dryer move corrected the alarm, but then other alarms were received indicating an apparent slug of CO progressing through the unit which would negatively impact the catalyst in the AC reactor. As a result, operations removed feed from the C2 splitter and flared the ECU process gas to the HP flare system.

- **Time when the incident was first observed, and duration of excess emissions**
  Excess emissions began with the ECU directing process gas to the HP Flare System on October 24, 2022, beginning at approximately 14:30 and ending when the ECU was making on spec ethylene and removal of tail gas from the flares on October 26, 2022 at approximately 16:30.

Excess emissions to the HP Flare System were reduced by quickly responding to the upset condition and minimizing flaring by re-establishing on spec ethylene production and tail gas usage as fuel for the furnaces. An after-action review was held on October 26, 2022 to review the incident and to determine follow-up corrective actions.

- **Estimated rate of excess emissions**

  The initial event resulted in use of the HP elevated flare for approximately 24 minutes and with visible emissions from the high-pressure elevated flare occurring for approximately 11 minutes as determined from reviewing the flare video footage. Method 22 observations were conducted shortly after the initial elevated flare usage ended and no further visible emissions were noted from the HP Flare System.

  The following emissions are the preliminary estimated excess emissions flared at the HP Flares during this event. Emission estimates are based on the HP header vent gas flow meter readings and gas chromatograph composition data at the time:

  CO2e: 4,320.16 tons
  CO: 15.16 tons
  NOx: 3.32 tons
  SO2: 0.0 tons
  PMfilt: 0.09 tons
  PM10: 0.36 tons
  PM2.5: 0.36 tons
  VOC: 10.07 tons
  HAP: 0.09 tons

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Anna Hensel, District Supervisor
Scott Beaudway, Air Quality Specialist

2700-FM-BAQ0023 2/2015

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

Date(s) of Inspection: 9/6/22	TV ☐ SM ☐ NM ☐ PA ☐ GP ☐ MEGA ☒	Permit #(s): PA 04-740 A, B, C	Expiration Date:	Case #: 04-740	PF ID #: 775836
Company Name: Shell Chemicals Appalachia		Municipality: Potter Twp.		County: Beaver	
Plant Name:		Physical Location: 300 Frankfort Rd.		Federal ID — Plant Code #: 46-1624986-1	
Responsible Official: William Watson		Mailing Address: 300 Frankfort Rd.			
Title: General Manager		Monaca PA 15061-2210			
Phone #(s): 724-709 2825					

Mark (X) All Inspection Types That Apply To This Inspection:

☐	Full Compliance Evaluation (FCE)	☐	Plan Approval Inspection	☐	File Review (FR)
☐	Operating Permit Inspection (PI)	☐	Initial Permit Inspection (IPI)	☒	Complaint Inspection (CI)
☒	Routine/Partial (RTPT)	☐	Follow-Up Inspection (Ref. Date:_____)	☐	Sample Collection (SC)
☐	Minor Source(s) Inspection (RFD)	☐	Stack Test Observation	☐	Multi-Media Inspection (MM)
☐	Other:	☐	Announced		

Annual Compliance Certification Received: ☐ YES ☐ NO ☒ N/A — Date Received:

AIMS Report Received: ☐ YES ☐ NO ☐ N/A — Date Received:

Mark (X) All Activities That Apply:

☐	File Review	☐	Pre-Inspection Briefing	☒	Exit Interview/Briefing
☒	Pre-Inspection Observations	☐	Check For New/Unreported Sources	☐	Sample(s) Collected
☐	Visible Emissions Observations	☐	Verify Operation of CEMS	☐	Other

Comments/Recommendations: Enforcement since last FCE ☐ Yes ☐ No (If yes, attach summary)

Today I observed Shell Chemicals Appalachia LLC and performed a site inspection of the facility.

Shell chemicals telephoned me at ~ 10:50 AM to report a malfunction of Visible emissions from the two Ground Enclosed Flares (C205A and C205B).

I met with Kim Kaal, Ken Taylor and Alan Binder of Shell chemicals.

Compliance Status: ☐ In ☒ Out ☐ Pending ☐ Awaiting Co. Report — Needs a Follow-Up Inspection? ☐ Yes ☒ No

Company Representative: Kimberly Kaal	Title: Environmental Mgr.	Signature:	Date: 9/6/22
DEP Representative: Scott Beaudoin	Title: AQS	Signature: Scott Beaudoin	Date/Time: 9/6/22

This document is official notification that a representative of the Department of Environmental Protection, Air Quality Program, inspected the identified site. The findings of this inspection are shown above and on any attached pages, and may include violations uncovered during the inspection. Violations may also be discovered upon review of sample results or from any additional review of Department records. Notification will be forthcoming, if such violations are noted.

 eFacts Inspection ID#: 347874 Date: 9/6/22 Reviewed By _____

☐ White – Regional Office ☐ Yellow – Site ☐ Pink – District Office

2700-FM-AQ0024 Rev. 2/99

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT
Continued

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

I observed the facilty from Route 68, near the Old Lock and Dam 6 Building. I began my observation at 10:50 AM. Kim Hall, Shell chemicals, called me to report a malfunction of visible emissions from the two Ground Enclosed Flares (C205A and C205B). The emissions are from rust buildup in the pipes, dislodged from the recent start-up of the Ethane Cracking Furnaces last night.
I observed light visible emissions from the two Ground Enclosed Flares this morning from 10:50 AM until 12:40 PM, when I left the facilty.
I entered the Shell Chemical facility at ~ 11:35 AM and met with Kim Hall. We discussed the malfunction. I did not observe any malodor or fugitive emissions during my inspection. I did not observe any other visible emissions during my inspection today.
Both Ethane Cracking Furnaces #1 and #5 are in operation today. (2, 3, 4, 6, 7 are in stand-by currently).
Kim Hall and Alan Binder verified the following sources are also in operation during my inspection today:
Combustion Turbines #1, #2 and #3.
Cogeneration Plant Cooling Tower
Process Cooling Tower
Low Pressure Header System
High Pressure Header system
Spent Caustic Header System
Storage Tanks (401, 404, 405, 406, 408)
Naptha and Storage Vessels
Equipment Components
WWTP
Plant Roadways

Company – plant name: Shell Chemical Appalachia LLC
Initials of representative interviewed:
Date: 9/6/22

Reviewed By _____

☐ White – Site ☐ Yellow – District Office ☐ Pink – Regional Office

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT
Continued

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

The following control equipment was in operation during my inspection:
SCR (031 & 035)
C101 and C101A
C102 and C102A
C103 and C103A
C104
C203
C204, C204A, C204B
C205, C205A, C205B, C205C
C206

Alan Binder and an operator performed A Method 22 observation of the Ground Enclosed Flares this morning at 8:50 AM. They took a photo of the VE from the Ground Enclosed Flare.

Shell Chemicals will email a malfunction Report to the Department for this incident.

I left the facility at ~ 12:40 PM. The visible emissions were very faint when I left.

The visible emissions are a violation of Source 205, condition #001, limiting VE to 0% for 5 minutes in any two-hour period.

I took one photo of the facility from Rt 68 across the River.

Company -- plant name: Shell Chemicals Appalachia LLC

Initials of representative interviewed:

Date: 9/6/22

Page 3 of 3

Reviewed By _____

☐ White – Site ☐ Yellow – District Office ☐ Pink – Regional Office

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

September 20, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source ID 205 High Pressure (HP) Header System Faint Brown Visible Emissions Malfunction Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for visible emissions observed from the high-pressure ground flares (HPGF) A & B (Source ID C205A, C205B) beginning on September 6, 2022. This Malfunction Report also corresponds with the Notice of Violation issued to Shell Chemical Appalachia LLC on September 14, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

  On September 5 at ~7:45PM ethane began to be fed into the ethane cracking furnaces to progress the ethane cracking unit (ECU) startup. With this activity commenced higher rates of planned startup flaring and higher temperatures within the HPGFs but within the design capacity of the HPGFs

  On September 6 beginning at daylight at ~8:00AM visible emissions were observed from the HPGF A and B stacks. Visible emissions were observed continuously as a predominantly brown discoloration contained within the exhaust plume from both HPGFs. These visible emissions have been recurring periodically since feed in to the ECU.

  In addition, HP Header gas chromatograph (GC) readings indicate that the vent gas composition was and is within design specifications and expectations during this time. Vent gas samples were taken on September 7, analyzed, and validate that GC readings are accurate.

Preliminary results of the investigation into these visible emissions indicate the cause is the likely presence of nitrogen oxides within the exhaust plumes. During the daylight hours, blue light photons are adsorbed by the nitrogen oxides present in the exhaust plume. The observer looking at the exhaust plumes only sees the green and red photons resulting in a brownish discoloration of the exhaust plumes depending on the amount of nitrogen oxides present. During this time, not all the processing equipment was available in the ECU thus the majority of the streams were being flared in the HPGFs.

Investigation into the event is ongoing for further details, cause, and any corrective actions. Additional evaluation of operational data has been requested from the flare vendor.

- **Time when the incident was first observed, and duration of excess emissions**
  September 6, 2022, beginning at 08:00 am, and ongoing recurring periodically during ECU startup activities. Visible emissions were validated to exceed 0% for 5 minutes within a 2-hour period via Method 22 observations on the morning of September 6, 2022. Method 22 was repeated periodically during this time frame. The visible emissions are also monitored by live flare camera video footage at the central control building and the data are also stored electronically.

- **Estimated rate of excess emissions**
  Visible emissions exceed 0% for > 5 minutes

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Mark Gorog September 19, 2022

Attachment 1 – July 22 FEOR and RO Tank Headspace Analysis

Site	Monaca	Monaca	Monaca		
Sample Name	FEOR A	FEOR B	T-39708 ROT		
Lab#					
Date Sampled	7/22/22	7/22/22	7/22/22		
Time Sampled	11:30	12:15	11:15		
Gas Temp, °F					
Gas Press, psi					
Cylinder#					

Customer
Shell

Pressure base 14.696psi

Analysis	Units	Method					
Hydrogen	Raw%	**GPA 1945**	0.22	0.05	0.02		
Helium	Raw%		<0.01	<0.01	0.01		
Oxygen	Raw%		<0.01	<0.01	<0.01		
Nitrogen	Raw%		24.57	25.58	15.01		
Carbon Dioxide	Raw%		0.08	0.03	0.10		
Methane	Raw%		7.27	2.73	43.43		
Ethane	Raw%		2.20	0.83	7.42		
Propane	Raw%		1.73	0.67	9.77		
Isobutane	Raw%		<0.01	<0.01	0.02		
n-Butane	Raw%		<0.01	<0.01	<0.01		
Isopentane	Raw%		<0.01	<0.01	<0.01		
n-Pentane	Raw%		<0.01	<0.01	<0.01		
Hexanes Plus	Raw%		<0.01	<0.01	0.01		
Total	Raw%		36.07	29.89	75.76		

Mark Gorog September 19, 2022

Attachment 2 – SCTO Emission Calculations

Attachment 2 - SCTO Emission Calculations				
Emission Unit(s) ID	=	*206, C206*		*Spent Caustic Thermal Oxidizer*
Parameter		**Value**		**Source / Basis**
Calcuation Inputs				
Fuel Gas (NG) Heat Input [HHV]	=	1.3	MMBtu	Calculated from measured fuel flow and site heating value
Fuel Gas (NG) Total Flow	=	33.3	Nm3	Measured from fuel flow control valve
Fuel Gas (NG) Total Flow	=	1261.2	scf	Converted from measured fuel flow
Natural Gas Density	=	0.717	kg/m3	Calculated site NG density
Natural Gas Heating Value [HHV]	=	1047.000	Btu/scf	Measured site NG heating value
Heat Input from Vent Gas [HHV]	=	8.2	MMBtu	Calculated from vent gas flow and heating value
Vent Gas (VG) Total Flow	=	270.2	Nm3	Calculated from vent blower design specs and duration
Vent Gas (VG) Total Flow	=	10240.6	scf	Converted from calculated VG flow
Vent Gas Density	=	0.064	lb/scf	Calculated VG density
Vent Gas (VG) Total Flow	=	652.0	lb	Converted from calculated VG flow
Vent Gas Heating Value [HHV]	=	799.7	Btu/scf	Calculated VG HHV
Vent Blower Design Rate	=	772.0	Nm3/hr	Blower design data sheet
Hydrocarbon DRE	=	99.9%	wt. %	SCTO design data sheet
PM (filterable) EF	=	0.0019	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM10 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
Fuel Gas VOC EF	=	0.0054	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
NOx EF	=	0.0680	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
Fuel Gas SO2 EF	=	0.0005882	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
Vent Gas Sulfur %	=	0.0000	wt %	No H2S or S present in HP Flare vent gas at this time
CO EF	=	0.0824	lb/MMBtu	AP-42, Table 1.4-1, 7/98.
CO2 EF	=	117.0	lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for natural gas
N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
C2H6 EF	=	0.0030	lb/MMBtu	AP-42, Table 1.4-3, 7/98.
H2SO4 EF	=	2.4E-05	lb/MMBtu	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
HAP EF	=	0.0018415	lb/MMBtu	AP-42, Table 1.4-3, 7/98.
Vent Gas Nitrogen %	=	45.7	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Methane %	=	28.4	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Ethane %	=	9.1	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Propane (VOC) %	=	17.9	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas MW	=	24.5	g/mol	Calculated from July 22 RO Tank Method GPA 1945 sample analysis balanced with N2
Nm3 to scf Conversion Factor	=	37.9	scf/Nm3	Constant
Total Hours	=	0.35	hr	Twenty-one (21) minutes of blower operation during July 4 visible emissions
Emissions Calculations				
PM Emissions	=	0.02	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM (filterable) EF)
PM10 Emissions	=	0.07	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM10 EF)
PM2.5 Emissions	=	0.07	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM2.5 EF)
VOC Emissions	=	0.12	lb	= (Fuel Gas HI) x (VOC EF) + (Vent Gas Total Flow) x (Vent Gas VOC Content) x (1-DRE)
NOx Emissions	=	0.65	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (NOx EF)
SO2 Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (Fuel Gas SO2 EF)
CO Emissions	=	0.78	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (CO EF)
CO2 Emissions	=	1112.44	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (CO2 EF)
N2O Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (N2O EF)
CH4 Emissions	=	0.19	lb	= (Fuel Gas HI) x (CH4 EF) + (Vent Gas Total Flow) x (Vent Gas Methane Content) x (1-DRE)
C2H6 Emissions	=	0.06	lb	= (Fuel Gas HI) x (C2H6 EF) + (Vent Gas Total Flow) x (Vent Gas Methane Content) x (1-DRE)
H2SO4 Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (H2SO4 EF)
HAP Emissions	=	0.02	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (HAP EF)
CO2e Emissions	=	1117.77	lb	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs.

* Excess emissions are calculated based upon the RO Tank headspace sample composition as the worst case for all three tanks, vent blower design flow rate, and measured fuel flow rate and characteristics. Duration of the calculation is for all times when the blower was active.

Mark Gorog September 19, 2022

Attachment 3 – HP Flare KO Drum, through RO and FEOR Tanks, Vent Loss Calculations

Vent gas losses were conservatively calculated from the HP flare knock out drum based upon the pressure differential (ΔP) between the drum and atmosphere accounting for all periods when ΔP was positive allowing for flow. The total calculation considers the drum pressure, pressure drop (resistance) from piping to the RO tank, backpressure from the RO tank liquid level relative to piping inlet, and backpressure from the relief valve. Additional factors include the specific gravity and vent gas composition as measured by the gas chromatograph downstream of the HP flare knock out drum. See Figure 1 below for the flow pathway visual.

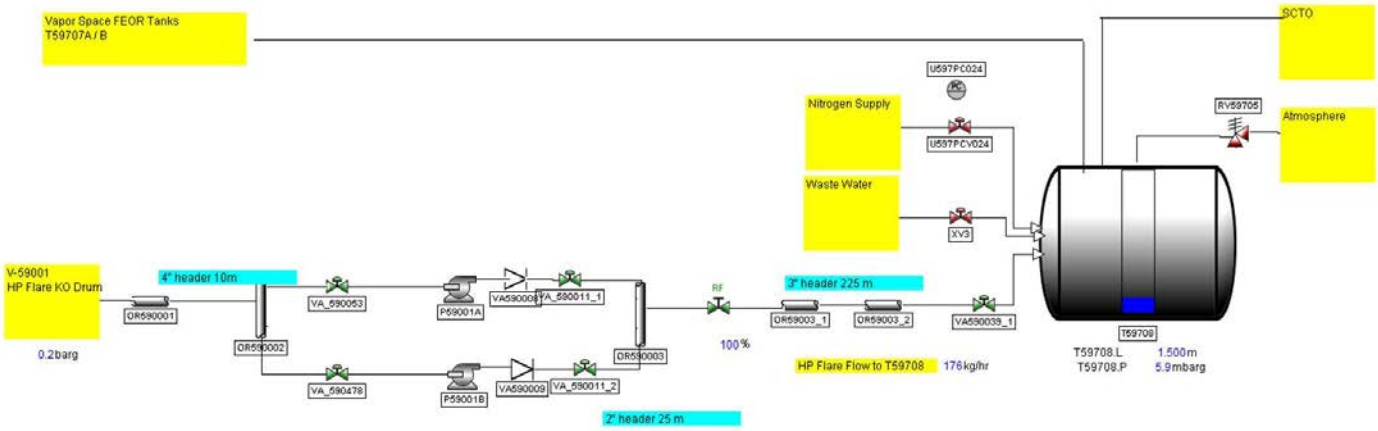

Figure 1: Vent Gas Flow Pathway from HP Flare KO Drum to Atmosphere. Note: this is a model and does not show normal flow path from RO Tank to SCTO.

Resistance is included from the total length, diameter, and friction factor of piping between the drum and RO tank. The calculation is conservative because there are additional valve and pump features in the line between the drum and tank which would contribute to resistance but have not been included for simplicity. Resistance, and ultimately flow conductance, from the pipe was calculated using the following Darcy's equation

The resistance offered by the straight pipe is calculated by using the following equation.

$$K_{Total} = \frac{f \cdot (L + L_{Add})}{D} + K_{Add}$$

where:
D - Diameter of the pipe *(m)*
f - Friction factor calculated by Colebrook's relation
K_{Total} - Total resistance offered by the pipe and fittings *(dimensionless)*
L - Length of pipe *(m)*
K_{Add} - Additional Resistance K factor due to fittings not associated with the straight pipe *(dimensionless)*
L_{Add} . Additional Length (m)

The flow conductance is then calculated from the total pipe resistance.

$$J = \frac{34.93447 \cdot D^2}{\sqrt{K_{Total}}}$$

where:
D - Diameter of the pipe *(m)*
J - Flow conductance *((kg/sec)/sqrt(kPa-kg/m^3))*
K_{Total} - Total resistance offered by the pipe *(dimensionless)*

Figure 2: Pipe Resistance and Flow Conductance Equations

Mass flowrate was calculated using the calculated flow conductance, ΔP, and density (specific gravity) in the system.

Many flow devices use flow conductance based on the following simplified form of the Darcy flow equation assuming constant density to calculate flow.

$$F_f = J\frac{\sqrt{\Delta P \cdot R_f \cdot MW_f}}{MW_f} = J\sqrt{\frac{\Delta P \cdot R_f}{MW_f}}$$

where:

F_f - Forward flow *(kg-mol/sec)*
J - Forward flow conductance *((kg/sec)/sqrt(kPa-kg/m^3))*
MW_f - Forward flow molecular weight *(kg/kg-mol)*
ΔP - Pressure drop across the flow device *(kPa)*
R_f - Forward flow mole density *(kg-mol/m^3)*

This equation is equivalent to the following equation on a mass basis

$$W = J\sqrt{\Delta P \cdot R_{mass}}$$

and it is equivalent to the following equation on a volume basis.

$$Q = J\sqrt{\frac{\Delta P}{R_{mass}}}$$

where:

R_{fmass} - Mass density *(kg/ m^3)*
Q - Volumetric flow *(m^3/sec)*
W - Mass flow *(kg/sec)*

Figure 3: Mass Flow Equation

Inputs to all calculations include a combination of site measured data, design data, and material physical properties. A summary of all inputs and outputs (and total emissions) are included in Emission Calculations tables below. The calculation was performed for all times when the HP flare knock out drum pressure was greater than the backpressure from the RO tank.

Attachment 3 - HP Flare System (Through FEOR and RO Tanks) Emissions				
Emission Unit(s) ID	=	***205, 401***		***HP Flare System (Through FEOR and RO Tanks)***
Parameter		***Value***		***Source / Basis***
Model and Calculation Inputs				
Vent Gas Flow Rate	=	Variable	kg/hr	Output from modified Darcy Formula (0 to 261.4 kg/hr)
Total Vent Gas Flow	=	15,891.40	kg	Calculated as Sum of Flow Rate When ΔP > 0
Vent Gas Nitrogen %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (2.76 to 85.00%)
Vent Gas Methane %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (7.48 to 86.17%)
Vent Gas Ethane %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (0 to 75.93%)
Vent Gas Propane (VOC) %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (0.18 to 88.66%)
Vent Gas Specific Gravity	=	Variable	-	HP Header Gas Chromatograph Measurement (0.58 to 1.34)
RO Tank Liquid Inlet Height	=	0.3969	m	RO Tank Data Sheet Nozzle Height + Diameter
RO Tank Liquid Level	=	Variable	m	RO Tank Liquid Level Data (~1.54 m avg)
RO Tank Liquid Head Level	=	Variable	m	Calculated Delta Between Liquid Level and Inlet Height (~1.1 m avg)
Water Head Pressure / Meter	=	0.0981	barg/m	Constant
RO Tank Liquid Backpressure	=	Variable	barg	Calculated (~0.108 barg avg)
RO Tank Backpressure	=	Variable	barg	RO Tank RV Pressure Transmitter Data (~0.0047 barg avg)
Total RO Tank Backpressure	=	Variable	barg	Sum of RO Tank Liquid Level and RV Setting Backpressure
HP Flare KO Drum Avg Pressure	=	Variable	barg	Pressure Transmitter Representative of HP Flare KO Drum
4" Pipe Length to RO Tank	=	10.0000	m	3D Model Data
3" Pipe Length to RO Tank	=	225.0000	m	3D Model Data
2" Pipe Length to RO Tank	=	25.0000	m	3D Model Data
4" Pipe Friction Factor	=	0.0164	-	Dimensionless Standard Friction Factor
3" Pipe Friction Factor	=	0.0175	-	Dimensionless Standard Friction Factor
2" Pipe Friction Factor	=	0.0207	-	Dimensionless Standard Friction Factor
4" Pipe Resistance	=	1.6093	-	Calculated Dimensionless Standard Friction Factor
3" Pipe Resistance	=	50.8386	-	Calculated Dimensionless Standard Friction Factor
2" Pipe Resistance	=	10.1763	-	Calculated Dimensionless Standard Friction Factor
4" Pipe Flow Conductance	=	0.2843	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
3" Pipe Flow Conductance	=	0.0283	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
2" Pipe Flow Conductance	=	0.0285	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
Total Flow Conductance	=	0.0200	((kg/sec)/sqrt(kPa-kg/m3))	Calculated as Inverse Square Root of Sum of Flow Conductance
kg to lb Conversion	=	2.2046	lb/kg	Constant
Vent Blower Stop Time	=	7/4/2022 12:43	date/time	Vent blower run status data
HP Flare KO Drum Refill Time	=	7/20/2022 11:19	date/time	HP Flare KO Drum liquid level data
Total Hours	=	133.60	hr	~8,016 Minutes Where ΔP > 0 (Note: less than total time delta)
Emissions Calculations				
CH4 Emissions	=	8,913.76	kg	Calculation Output Flow x CH4 Wt% (sum each point when differential pressure > 0)
C2H6 Emissions	=	1,769.30	kg	Calculation Output Flow x C2H6 Wt%
VOC (C3H8) Emissions	=	2,020.28	kg	Calculation Output Flow x C3H8 Wt%
CO2e Emissions	=	222,844.00	kg	CH4 Emissions Adjusted for CH4 GWP
CH4 Emissions	=	19,651.28	lb	Converted Calculation Output
C2H6 Emissions	=	3,900.60	lb	Converted Calculation Output
VOC (C3H8) Emissions	=	4,453.91	lb	Converted Calculation Output
CO2e Emissions	=	491,281.88	lb	CH4 Emissions Adjusted for CH4 GWP
CH4 Emissions	=	9.83	tons	Converted Calculation Output
C2H6 Emissions	=	1.95	tons	Converted Calculation Output
VOC (C3H8) Emissions	=	2.23	tons	Converted Calculation Output
CO2e Emissions	=	245.64	tons	CH4 Emissions Adjusted for CH4 GWP

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

September 14, 2022

NOTICE OF VIOLATION

PFID: 775836
INSP: 3417874, 3419397
ENF#: 407274

VIA EMAIL: Kimberly.Kaal@shell.com

Kimberly Kaal, Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

Re: PA-04-00740C
Visible Emissions
Shell Chemical Appalachia LLC
Potter Township
Beaver County

Dear Kimberly Kaal:

The Shell Chemical Appalachia LLC ("Shell") Petrochemicals Complex is authorized to operate pursuant to plan approvals PA-04-00740A, PA-04-00740B, and PA-04-00740C. On September 6, 2022, Shell reported to the Department that on September 6, 2022, visible emissions were observed from the high-pressure (HP) ground flares (Sources C205A & C205B). I observed intermittent visible emissions from the HP ground flares from 10:50 AM to 12:40 PM on September 6, 2022. I observed intermittent visible emissions from the HP ground flares from 10:22 AM to 11:22 AM on September 8, 2022. The Department has identified the following violations from these events:

1. PA-04-00740C, Section D, Source 205, Condition #001, states visible emissions from both the HP ground flares and emergency elevated flares shall not exceed 0% except for a total of five minutes during any consecutive two-hour period. By permitting visible emissions greater than 0% opacity from the HP ground flares in excess of five minutes on September 6, 2022 and September 8, 2022, Shell caused violations of PA-04-00740C and 25 Pa. Code § 127.25.

2. 40 CFR § 60.18 (b)(1), states flares shall be designed for and operated with no visible emissions as determined by the methods specified in paragraph (f), except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. By permitting these visible emissions from the HP ground flares on September 6, 2022 and September 8, 2022, Shell caused a violation of 40 CFR § 60.18.

The above violation(s) constitute unlawful conduct and a public nuisance as defined by Sections 8 and 13 of the Air Pollution Control Act (APCA), 35 P.S. Sections 4008 and 4013, respectively. Violations of DEP's Air Quality Regulations are subject to the penalties of Sections 9 and 9.1 of the APCA. Each day the violation continues constitutes a separate offense.

This Notice of Violation is neither an order nor any other final action of DEP. It neither imposes nor waives any enforcement action available to DEP under any of its statutes. If DEP determines that an enforcement action is appropriate, you will be notified of the action.

If you have any questions concerning this matter, please contact me at sbeaudway@pa.gov or at 412.417.7952.

Sincerely,

Scott Beaudway/SB

Scott Beaudway
Air Quality Specialist
Air Quality

cc: E. Speicher, Environmental Group Manager
A. Hensel, District Supervisor
K. Goddard, Compliance Specialist
Central Office (via email)
04-00740 Enforcement File

2700-FM-BAQ0023 2/2015

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

Date(s) of Inspection:	TV ☐ PA ☐ SM ☐ GP ☐ NM ☐ MEGA ☒	Permit #(s):	Expiration Date:	Case #:	PF ID #:
9/8/22		PA04-740 A, B, C		04-740	775836

Company Name:	Municipality:	County:
Shell Chemicals App.	Potter Twp.	Beaver
Plant Name:	**Physical Location:**	**Federal ID — Plant Code #:**
	300 Frankfort Rd.	46-1624986-1

Responsible Official:	Mailing Address:
William Watson	300 Frankfort Rd.
Title:	
General Manager	Monaca, PA 15061
Phone #(s):	
724 709 2852	

Mark (X) All Inspection Types That Apply To This Inspection:

☐	Full Compliance Evaluation (FCE)	☐	Plan Approval Inspection	☐	File Review (FR)
☐	Operating Permit Inspection (PI)	☐	Initial Permit Inspection (IPI)	☒	Complaint Inspection (CI)
☒	Routine/Partial (RTPT)	☐	Follow-Up Inspection (Ref. Date:_____)	☐	Sample Collection (SC)
☐	Minor Source(s) Inspection (RFD)	☐	Stack Test Observation	☐	Multi-Media Inspection (MM)
☐	Other:	☐	Announced		

Annual Compliance Certification Received: ☐ YES ☐ NO ☐ N/A	Date Received:
AIMS Report Received: ☐ YES ☐ NO ☐ N/A	Date Received:

Mark (X) All Activities That Apply:

☐	File Review	☒	Pre-Inspection Briefing	☒	Exit Interview/Briefing
☒	Pre-Inspection Observations	☐	Check For New/Unreported Sources	☐	Sample(s) Collected
☐	Visible Emissions Observations	☐	Verify Operation of CEMS	☐	Other

Comments/Recommendations: Enforcement since last FCE ☐ Yes ☐ No (If yes, attach summary)

Today I performed a Routine Partial Inspection and a Complaint Inspection at Shell Chemicals Appalachia LLC facility.

I observed the facility from the Plant Entrance #3 area. I observed visible emissions from the two Ground Enclosed Flares (C205 A and C205 B). I took a photo of the facility from my location at Plant Entrance #3 and also a close up of the two Ground Enclosed Flare Stacks. The weather was 67°F, clear, dry.

Compliance Status: ☐ In ☒ Out ☐ Pending ☐ Awaiting Co. Report	Needs a Follow-Up Inspection? ☐ Yes ☒ No	
Company Representative: Kimberly Kaal	Title: Environmental Mgr.	Signature: [signature] Date: 9/8/22
DEP Representative: Scott Beardsley	Title: AQS	Signature: Scott Beardsley Date/Time: 9/8/22

This document is official notification that a representative of the Department of Environmental Protection, Air Quality Program, inspected the identified site. The findings of this inspection are shown above and on any attached pages, and may include violations uncovered during the inspection. Violations may also be discovered upon review of sample results or from any additional review of Department records. Notification will be forthcoming, if such violations are noted.

 eFacts Inspection ID#: 3419397 Date: 9/8/22 Reviewed By _____

☐ White – Regional Office ☐ Yellow – Site ☐ Pink – District Office

2700-FM-BAQ0024 2/2015
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT
Continued

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

I observed the facility from 10:22 AM - 11:22 AM The emissions were Intermittant from the two Ground Enclosed Flares. I did not observe any visible emissions from any other sources or Control devices at Shell chemicals. I did not observe any fugitive or malodor emissions.

I crossed the Ohio River and inspected Vanport and Beaver. I did not observe any malodors in Vanport or Beaver, down wind of Shell Chemicals.

I arrived on site at the Shell Chemicals facility at 12:16 PM. I met with Kim Neal, Shell Chemicals, and we discussed the ongoing visible emissions from the Ground Enclosed Flare. Daniel Gallo, Shell Engineer, provided the Flare Temperatur Data I looked the the Ground Enclosed Flare temperatures:
C205 A:
Thermocouple A = 527 °C, B = 519 °C, C = 738 °C
C205 B:
Thermocouple A = 336 °C, B = 560 °C; C = 450 °C.

Shell [redacted] Chemicals has continued to perform Method 22 observations of the Ground Enclosed Flare, typically two observations per day. Shell chemicals. The malfuretion event causing the visible emissions [redacted] is ongoing, though the visible emissions are intermittent and of less intensity than I observed on Tuesday.

I did not observe any other visible emission while I was on site at Shell Chemicals. The visible emissions from the two Ground Enclosed Flares ceared and I did not observe any VE while I was on site. I did not observe any fugitive or malodor emissions from Shell Chemicals today.

Company – plant name:	Initials of representative interviewed:	Date:
Shell Chemicals Appalachia LLC.		9/8/22

Reviewed By _____

☐ White – Regional Office ☐ Yellow – Site ☐ Pink – District Office

2700-FM-BAQ0024 2/2015

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT
Continued

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

The following Sources are in operation today during my inspection:
Ethane Cracking Furnaces #1, #3, #5
Combustion Turbines #1, #2, #3
Cogeneration Plant Cooling Tower.
Process Cooling Tower
Low Pressure Header system
High Pressure Header system
Spent Caustic Header System
Storage Tanks (401, 404, 405, 406, 408)
Methanol Storage Vessels
WWTP
Plant Roadways.

The following control devices in operation during my inspection:
SCR (C031, C033, C035)
C101, C101A
C102, C102A
C103, C103A
C104
C203
C204, C204A, C204B
C205, C205A, C205B, C205C
C206

I also met with Ken Taylor, HSSE Manager, Shell Chemicals.

Company -- plant name:	Initials of representative interviewed:	Date:
Shell Chemicals Appalachia LLC		9/8/22

Page 3 of 3

Reviewed By _____

☐ White – Regional Office ☐ Yellow – Site ☐ Pink – District Office

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

September 20, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source ID 205 High Pressure (HP) Header System Faint Brown Visible Emissions Malfunction Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for visible emissions observed from the high-pressure ground flares (HPGF) A & B (Source ID C205A, C205B) beginning on September 6, 2022. This Malfunction Report also corresponds with the Notice of Violation issued to Shell Chemical Appalachia LLC on September 14, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

  On September 5 at ~7:45PM ethane began to be fed into the ethane cracking furnaces to progress the ethane cracking unit (ECU) startup. With this activity commenced higher rates of planned startup flaring and higher temperatures within the HPGFs but within the design capacity of the HPGFs

  On September 6 beginning at daylight at ~8:00AM visible emissions were observed from the HPGF A and B stacks. Visible emissions were observed continuously as a predominantly brown discoloration contained within the exhaust plume from both HPGFs. These visible emissions have been recurring periodically since feed in to the ECU.

  In addition, HP Header gas chromatograph (GC) readings indicate that the vent gas composition was and is within design specifications and expectations during this time. Vent gas samples were taken on September 7, analyzed, and validate that GC readings are accurate.

Preliminary results of the investigation into these visible emissions indicate the cause is the likely presence of nitrogen oxides within the exhaust plumes. During the daylight hours, blue light photons are adsorbed by the nitrogen oxides present in the exhaust plume. The observer looking at the exhaust plumes only sees the green and red photons resulting in a brownish discoloration of the exhaust plumes depending on the amount of nitrogen oxides present. During this time, not all the processing equipment was available in the ECU thus the majority of the streams were being flared in the HPGFs.

Investigation into the event is ongoing for further details, cause, and any corrective actions. Additional evaluation of operational data has been requested from the flare vendor.

- **Time when the incident was first observed, and duration of excess emissions**
  September 6, 2022, beginning at 08:00 am, and ongoing recurring periodically during ECU startup activities. Visible emissions were validated to exceed 0% for 5 minutes within a 2-hour period via Method 22 observations on the morning of September 6, 2022. Method 22 was repeated periodically during this time frame. The visible emissions are also monitored by live flare camera video footage at the central control building and the data are also stored electronically.

- **Estimated rate of excess emissions**
  Visible emissions exceed 0% for > 5 minutes

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Hensel, District Supervisor

Mark Gorog September 19, 2022

Attachment 1 – July 22 FEOR and RO Tank Headspace Analysis

Site	Monaca	Monaca	Monaca		
Sample Name	FEOR A	FEOR B	T-39708 ROT		
Lab#					
Date Sampled	7/22/22	7/22/22	7/22/22		
Time Sampled	11:30	12:15	11:15		
Gas Temp, °F					
Gas Press, psi					
Cylinder#					

Customer
Shell

Pressure base 14.696psi

Analysis	Units	Method					
Hydrogen	Raw%	**GPA 1945**	0.22	0.05	0.02		
Helium	Raw%		<0.01	<0.01	0.01		
Oxygen	Raw%		<0.01	<0.01	<0.01		
Nitrogen	Raw%		24.57	25.58	15.01		
Carbon Dioxide	Raw%		0.08	0.03	0.10		
Methane	Raw%		7.27	2.73	43.43		
Ethane	Raw%		2.20	0.83	7.42		
Propane	Raw%		1.73	0.67	9.77		
Isobutane	Raw%		<0.01	<0.01	0.02		
n-Butane	Raw%		<0.01	<0.01	<0.01		
Isopentane	Raw%		<0.01	<0.01	<0.01		
n-Pentane	Raw%		<0.01	<0.01	<0.01		
Hexanes Plus	Raw%		<0.01	<0.01	0.01		
Total	Raw%		36.07	29.89	75.76		

Mark Gorog September 19, 2022

Attachment 2 – SCTO Emission Calculations

Attachment 2 - SCTO Emission Calculations				
Emission Unit(s) ID	=	*206, C206*		*Spent Caustic Thermal Oxidizer*
Parameter		***Value***		***Source / Basis***
Calcuation Inputs				
Fuel Gas (NG) Heat Input [HHV]	=	1.3	MMBtu	Calculated from measured fuel flow and site heating value
Fuel Gas (NG) Total Flow	=	33.3	Nm3	Measured from fuel flow control valve
Fuel Gas (NG) Total Flow	=	1261.2	scf	Converted from measured fuel flow
Natural Gas Density	=	0.717	kg/m3	Calculated site NG density
Natural Gas Heating Value [HHV]	=	1047.000	Btu/scf	Measured site NG heating value
Heat Input from Vent Gas [HHV]	=	8.2	MMBtu	Calculated from vent gas flow and heating value
Vent Gas (VG) Total Flow	=	270.2	Nm3	Calculated from vent blower design specs and duration
Vent Gas (VG) Total Flow	=	10240.6	scf	Converted from calculated VG flow
Vent Gas Density	=	0.064	lb/scf	Calculated VG density
Vent Gas (VG) Total Flow	=	652.0	lb	Converted from calculated VG flow
Vent Gas Heating Value [HHV]	=	799.7	Btu/scf	Calculated VG HHV
Vent Blower Design Rate	=	772.0	Nm3/hr	Blower design data sheet
Hydrocarbon DRE	=	99.9%	wt. %	SCTO design data sheet
PM (filterable) EF	=	0.0019	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM10 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
Fuel Gas VOC EF	=	0.0054	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
NOx EF	=	0.0680	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
Fuel Gas SO2 EF	=	0.0005882	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
Vent Gas Sulfur %	=	0.0000	wt %	No H2S or S present in HP Flare vent gas at this time
CO EF	=	0.0824	lb/MMBtu	AP-42, Table 1.4-1, 7/98.
CO2 EF	=	117.0	lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for natural gas
N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
C2H6 EF	=	0.0030	lb/MMBtu	AP-42, Table 1.4-3, 7/98.
H2SO4 EF	=	2.4E-05	lb/MMBtu	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
HAP EF	=	0.0018415	lb/MMBtu	AP-42, Table 1.4-3, 7/98.
Vent Gas Nitrogen %	=	45.7	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Methane %	=	28.4	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Ethane %	=	9.1	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas Propane (VOC) %	=	17.9	wt %	July 22 RO Tank Method GPA 1945 sample analysis balanced with N2 and converted to wt%
Vent Gas MW	=	24.5	g/mol	Calculated from July 22 RO Tank Method GPA 1945 sample analysis balanced with N2
Nm3 to scf Conversion Factor	=	37.9	scf/Nm3	Constant
Total Hours	=	0.35	hr	Twenty-one (21) minutes of blower operation during July 4 visible emissions
Emissions Calculations				
PM Emissions	=	0.02	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM (filterable) EF)
PM10 Emissions	=	0.07	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM10 EF)
PM2.5 Emissions	=	0.07	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (PM2.5 EF)
VOC Emissions	=	0.12	lb	= (Fuel Gas HI) x (VOC EF) + (Vent Gas Total Flow) x (Vent Gas VOC Content) x (1-DRE)
NOx Emissions	=	0.65	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (NOx EF)
SO2 Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (Fuel Gas SO2 EF)
CO Emissions	=	0.78	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (CO EF)
CO2 Emissions	=	1112.44	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (CO2 EF)
N2O Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (N2O EF)
CH4 Emissions	=	0.19	lb	= (Fuel Gas HI) x (CH4 EF) + (Vent Gas Total Flow) x (Vent Gas Methane Content) x (1-DRE)
C2H6 Emissions	=	0.06	lb	= (Fuel Gas HI) x (C2H6 EF) + (Vent Gas Total Flow) x (Vent Gas Methane Content) x (1-DRE)
H2SO4 Emissions	=	0.00	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (H2SO4 EF)
HAP Emissions	=	0.02	lb	= (Fuel Gas (NG) Heat Input [HHV]) + (Heat Input from Vent Gas [HHV]) x (HAP EF)
CO2e Emissions	=	1117.77	lb	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs.

* Excess emissions are calculated based upon the RO Tank headspace sample composition as the worst case for all three tanks, vent blower design flow rate, and measured fuel flow rate and characteristics. Duration of the calculation is for all times when the blower was active.

Mark Gorog September 19, 2022

Attachment 3 – HP Flare KO Drum, through RO and FEOR Tanks, Vent Loss Calculations

Vent gas losses were conservatively calculated from the HP flare knock out drum based upon the pressure differential (ΔP) between the drum and atmosphere accounting for all periods when ΔP was positive allowing for flow. The total calculation considers the drum pressure, pressure drop (resistance) from piping to the RO tank, backpressure from the RO tank liquid level relative to piping inlet, and backpressure from the relief valve. Additional factors include the specific gravity and vent gas composition as measured by the gas chromatograph downstream of the HP flare knock out drum. See Figure 1 below for the flow pathway visual.

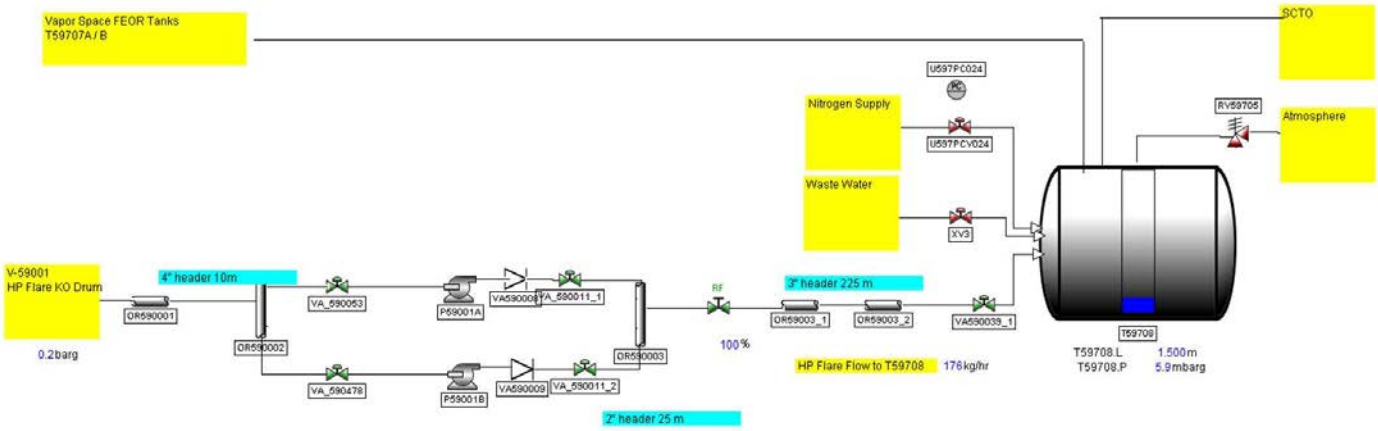

Figure 1: Vent Gas Flow Pathway from HP Flare KO Drum to Atmosphere. Note: this is a model and does not show normal flow path from RO Tank to SCTO.

Resistance is included from the total length, diameter, and friction factor of piping between the drum and RO tank. The calculation is conservative because there are additional valve and pump features in the line between the drum and tank which would contribute to resistance but have not been included for simplicity. Resistance, and ultimately flow conductance, from the pipe was calculated using the following Darcy's equation

The resistance offered by the straight pipe is calculated by using the following equation.

$$K_{Total} = \frac{f \cdot (L + L_{Add})}{D} + K_{Add}$$

where:
D - Diameter of the pipe *(m)*
f - Friction factor calculated by Colebrook's relation
K_{Total} - Total resistance offered by the pipe and fittings *(dimensionless)*
L - Length of pipe *(m)*
K_{Add} - Additional Resistance K factor due to fittings not associated with the straight pipe *(dimensionless)*
L_{Add} . Additional Length (m)

The flow conductance is then calculated from the total pipe resistance.

$$J = \frac{34.93447 \cdot D^2}{\sqrt{K_{Total}}}$$

where:
D - Diameter of the pipe *(m)*
J - Flow conductance *((kg/sec)/sqrt(kPa-kg/m^3))*
K_{Total} - Total resistance offered by the pipe *(dimensionless)*

Figure 2: Pipe Resistance and Flow Conductance Equations

Mass flowrate was calculated using the calculated flow conductance, ΔP, and density (specific gravity) in the system.

Many flow devices use flow conductance based on the following simplified form of the Darcy flow equation assuming constant density to calculate flow.

$$F_f = J\frac{\sqrt{\Delta P \cdot R_f \cdot MW_f}}{MW_f} = J\sqrt{\frac{\Delta P \cdot R_f}{MW_f}}$$

where:

F_f - Forward flow *(kg-mol/sec)*
J - Forward flow conductance *((kg/sec)/sqrt(kPa-kg/m^3))*
MW_f - Forward flow molecular weight *(kg/kg-mol)*
ΔP - Pressure drop across the flow device *(kPa)*
R_f - Forward flow mole density *(kg-mol/m^3)*

This equation is equivalent to the following equation on a mass basis

$$W = J\sqrt{\Delta P \cdot R_{mass}}$$

and it is equivalent to the following equation on a volume basis.

$$Q = J\sqrt{\frac{\Delta P}{R_{mass}}}$$

where:

R_{fmass} - Mass density *(kg/ m^3)*
Q - Volumetric flow *(m^3/sec)*
W - Mass flow *(kg/sec)*

Figure 3: Mass Flow Equation

Inputs to all calculations include a combination of site measured data, design data, and material physical properties. A summary of all inputs and outputs (and total emissions) are included in Emission Calculations tables below. The calculation was performed for all times when the HP flare knock out drum pressure was greater than the backpressure from the RO tank.

Attachment 3 - HP Flare System (Through FEOR and RO Tanks) Emissions				
Emission Unit(s) ID	=	***205, 401***		***HP Flare System (Through FEOR and RO Tanks)***
Parameter		***Value***		***Source / Basis***
Model and Calculation Inputs				
Vent Gas Flow Rate	=	Variable	kg/hr	Output from modified Darcy Formula (0 to 261.4 kg/hr)
Total Vent Gas Flow	=	15,891.40	kg	Calculated as Sum of Flow Rate When ΔP > 0
Vent Gas Nitrogen %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (2.76 to 85.00%)
Vent Gas Methane %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (7.48 to 86.17%)
Vent Gas Ethane %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (0 to 75.93%)
Vent Gas Propane (VOC) %	=	Variable	wt %	HP Header Gas Chromatograph Measurement Converted to wt% (0.18 to 88.66%)
Vent Gas Specific Gravity	=	Variable	-	HP Header Gas Chromatograph Measurement (0.58 to 1.34)
RO Tank Liquid Inlet Height	=	0.3969	m	RO Tank Data Sheet Nozzle Height + Diameter
RO Tank Liquid Level	=	Variable	m	RO Tank Liquid Level Data (~1.54 m avg)
RO Tank Liquid Head Level	=	Variable	m	Calculated Delta Between Liquid Level and Inlet Height (~1.1 m avg)
Water Head Pressure / Meter	=	0.0981	barg/m	Constant
RO Tank Liquid Backpressure	=	Variable	barg	Calculated (~0.108 barg avg)
RO Tank Backpressure	=	Variable	barg	RO Tank RV Pressure Transmitter Data (~0.0047 barg avg)
Total RO Tank Backpressure	=	Variable	barg	Sum of RO Tank Liquid Level and RV Setting Backpressure
HP Flare KO Drum Avg Pressure	=	Variable	barg	Pressure Transmitter Representative of HP Flare KO Drum
4" Pipe Length to RO Tank	=	10.0000	m	3D Model Data
3" Pipe Length to RO Tank	=	225.0000	m	3D Model Data
2" Pipe Length to RO Tank	=	25.0000	m	3D Model Data
4" Pipe Friction Factor	=	0.0164	-	Dimensionless Standard Friction Factor
3" Pipe Friction Factor	=	0.0175	-	Dimensionless Standard Friction Factor
2" Pipe Friction Factor	=	0.0207	-	Dimensionless Standard Friction Factor
4" Pipe Resistance	=	1.6093	-	Calculated Dimensionless Standard Friction Factor
3" Pipe Resistance	=	50.8386	-	Calculated Dimensionless Standard Friction Factor
2" Pipe Resistance	=	10.1763	-	Calculated Dimensionless Standard Friction Factor
4" Pipe Flow Conductance	=	0.2843	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
3" Pipe Flow Conductance	=	0.0283	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
2" Pipe Flow Conductance	=	0.0285	((kg/sec)/sqrt(kPa-kg/m3))	Calculated from Darcy Equation
Total Flow Conductance	=	0.0200	((kg/sec)/sqrt(kPa-kg/m3))	Calculated as Inverse Square Root of Sum of Flow Conductance
kg to lb Conversion	=	2.2046	lb/kg	Constant
Vent Blower Stop Time	=	7/4/2022 12:43	date/time	Vent blower run status data
HP Flare KO Drum Refill Time	=	7/20/2022 11:19	date/time	HP Flare KO Drum liquid level data
Total Hours	=	133.60	hr	~8,016 Minutes Where ΔP > 0 (Note: less than total time delta)
Emissions Calculations				
CH4 Emissions	=	8,913.76	kg	Calculation Output Flow x CH4 Wt% (sum each point when differential pressure > 0)
C2H6 Emissions	=	1,769.30	kg	Calculation Output Flow x C2H6 Wt%
VOC (C3H8) Emissions	=	2,020.28	kg	Calculation Output Flow x C3H8 Wt%
CO2e Emissions	=	222,844.00	kg	CH4 Emissions Adjusted for CH4 GWP
CH4 Emissions	=	19,651.28	lb	Converted Calculation Output
C2H6 Emissions	=	3,900.60	lb	Converted Calculation Output
VOC (C3H8) Emissions	=	4,453.91	lb	Converted Calculation Output
CO2e Emissions	=	491,281.88	lb	CH4 Emissions Adjusted for CH4 GWP
CH4 Emissions	=	9.83	tons	Converted Calculation Output
C2H6 Emissions	=	1.95	tons	Converted Calculation Output
VOC (C3H8) Emissions	=	2.23	tons	Converted Calculation Output
CO2e Emissions	=	245.64	tons	CH4 Emissions Adjusted for CH4 GWP

2700-FM-BAQ0023 2/2015

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

Date(s) of Inspection:	TV ☐ PA ☐ SM ☐ GP ☐ NM ☐ MEGA ■	Permit #(s):	Expiration Date:	Case #:	PF ID #:
9/13/22		PA-04-740	A, B, C	04-740	775836

Company Name:	Municipality:	County:
Shell Chemicals App.	Potter Twp.	Beaver

Plant Name:	Physical Location:	Federal ID — Plant Code #:
	300 Frankfort Rd.	46-16249 86-1

Responsible Official:	Mailing Address:
William Watson	300 Frankfort Rd.
Title: General Manager	Monaca PA 15061
Phone #(s): 724-709-2852	

Mark (X) All Inspection Types That Apply To This Inspection:

☐	Full Compliance Evaluation (FCE)	☐	Plan Approval Inspection	☐	File Review (FR)
☐	Operating Permit Inspection (PI)	☐	Initial Permit Inspection (IPI)	■	Complaint Inspection (CI)
■	Routine/Partial (RTPT)	☐	Follow-Up Inspection (Ref. Date:_____)	☐	Sample Collection (SC)
☐	Minor Source(s) Inspection (RFD)	☐	Stack Test Observation	☐	Multi-Media Inspection (MM)
☐	Other:	☐	Announced		

Annual Compliance Certification Received: ☐ YES ☐ NO ☐ N/A	Date Received:
AIMS Report Received: ☐ YES ☐ NO ☐ N/A	Date Received:

Mark (X) All Activities That Apply:

☐	File Review	■	Pre-Inspection Briefing	■	Exit Interview/Briefing
■	Pre-Inspection Observations	☐	Check For New/Unreported Sources	☐	Sample(s) Collected
☐	Visible Emissions Observations	☐	Verify Operation of CEMS	☐	Other

Comments/Recommendations: Enforcement since last FCE ☐ Yes ☐ No (If yes, attach summary)

Today I performed a Routine Partial Inspection and complaint Inspection at Shell chemicals Appalachia LLC facility in Potter Twp.

I inspected the area downwind of Shell Chemicals in Vanport and Beaver. I did not observe any malodor emissions. It was 68°F, partly cloudy, dry.

I observed Shell chemicals facility from across the Ohio River by the old Lock and Dam 6.

Compliance Status: ☐ In ■ Out ☐ Pending ☐ Awaiting Co. Report	Needs a Follow-Up Inspection? ☐ Yes ■ No	
Company Representative: Kimberly Krmec	Title: Environmental Manager	Signature: Kimberly Krmec — Date: 9/13/22
DEP Representative: Scott Beaudway	Title: AQS	Signature: Scott Beaudway — Date/Time: 9/13/22

This document is official notification that a representative of the Department of Environmental Protection, Air Quality Program, inspected the identified site. The findings of this inspection are shown above and on any attached pages, and may include violations uncovered during the inspection. Violations may also be discovered upon review of sample results or from any additional review of Department records. Notification will be forthcoming, if such violations are noted.

☐ White – Regional Office ☐ Yellow – Site ☐ Pink – District Office

I observed Shell Chemicals from 10:50 Am to 12:28 pm. Initially, I did not observe any visible, fugitive or malodor emissions.

At 11:17 Am I began to observe intermittant visible emissions from the high pressure ground endured flares (C205 A and C205 B).

I observed at least one minute of visible emissions during the following time periods: 11:17 to 11:18, 11:19 to 11:20, 11:21 to 11:22, 12:05 to 12:06, 12:06 to 12:07, 12:07 to 12:08, 12:24 to 12:25. I used a stopwatch to measure the elapsed times.

Emissions from the HP ground flares greater than five minutes in a two hour period is a violation of Section D, Source 205, condition #001 of PA 04-740C.

I informed Kim Kaal, Shell Chemicals, of my observations and entered the facility at [redacted] 1:35 pm. I discussed the visible emissions with Kim Kaal. Kim stated that the initial malfunction from 9/6/22 is ongoing. All processes are not yet in operation. Since all processes following the Ethane Cracking Furnaces are not yet online to process the products, the products must be sent to the HP ground Flares for control. It is theorized the the heavy hydrocarbons are causing the visible emissions. Shell Chemicals anticipates that by this Friday, 9/16/22, more downstream processes will be online which will reduce or eliminate the visible emissions.

Company -- plant name:	Initials of representative interviewed:	Date:
Shell Chemicals Appalachia LLC.		9/13/22

Reviewed By _____

☐ White – Site ☐ Yellow – District Office ☐ Pink – Regional Office

2700-FM-AQ0024 Rev. 2/99
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT
Continued

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

We discussed the elevated Flare (C205C). The elevated Flare did operate approximately three times over the last week. Each event was very short in duration, under one minute. Kim Kaal will email with a list of the day, time and duration of the elevated flare events since 9/6/22.

The following Source were in operation during my observation:
Ethane Cracking Furnaces (#3, 5, 7)
Combustion Turbines (#1, 2, 3)
Process Cooling Tower
Cogeneration Plant Cooling Tower
Low and High Pressure Header Systems
Spent Caustic Header system.
Storage Tanks (401, 404, 405, 406, 408).
Methanol Storge Vessels.
WWTP
Plant Roadways.

The following Control Devices were in operation during my observation:
SCR (033, 035, 037)
C101, C101A, C102, C102A, C103, C103A
C104
C203
C204, C204A, C204B
C205, C205A, C205B, C205C.
C206.

Company -- plant name:	Initials of representative interviewed:	Date:
Shell Chemicals Appalachia LLC		9/13/22

Reviewed By _____

☐ White – Site ☐ Yellow – District Office ☐ Pink – Regional Office

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PFID: 775836
INSP: 3394025
ENFID: 405955

July 21, 2022

NOTICE OF VIOLATION

VIA EMAIL: Kimberly.Kaal@shell.com

Kimberly Kaal, Environmental Manager
Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

Re: PA-04-00740C
Visible Emissions
Shell Chemical Appalachia LLC
Potter Township
Beaver County

Dear Kimberly Kaal:

The Shell Chemical Appalachia LLC ("Shell") Petrochemicals Complex is authorized to operate pursuant to plan approvals PA-04-00740A, PA-04-00740B, and PA-04-00740C. On June 23, 2022, Shell reported to the Department that on June 23, 2022, visible emissions were observed from the multipoint ground flare ("MPGF", Source C204B) for approximately 11 minutes. The Department has identified the following violations from this event:

1. PA-04-00740C, Section D, Source 204, Condition #001, states visible emissions from both the LP incinerator and MPGF shall not exceed 0% except for a total of five minutes during any consecutive two-hour period. By permitting visible emissions greater than 0% opacity from the MPGF in excess of five minutes on June 23, 2022, Shell caused violations of PA-04-00740C and 25 Pa. Code § 127.25.

2. 40 CFR § 60.18 (b)(1), states flares shall be designed for and operated with no visible emissions as determined by the methods specified in paragraph (f), except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. By permitting these visible emissions from the MPGF on June 23, 2022, Shell caused a violation of 40 CFR § 60.18.

The above violation(s) constitute unlawful conduct and a public nuisance as defined by Sections 8 and 13 of the Air Pollution Control Act (APCA), 35 P.S. Sections 4008 and 4013, respectively. Violations of DEP's Air Quality Regulations are subject to the penalties of Sections 9 and 9.1 of the APCA. Each day the violation continues constitutes a separate offense.

This Notice of Violation is neither an order nor any other final action of DEP. It neither imposes nor waives any enforcement action available to DEP under any of its statutes. If DEP determines that an enforcement action is appropriate, you will be notified of the action.

If you have any questions concerning this matter, please contact me at sbeaudway@pa.gov or at 412.417.7952.

Sincerely,

Scott Beaudway/SB

Scott Beaudway
Air Quality Specialist
Air Quality

cc: E. Speicher, Environmental Group Manager
A. Hensel, District Supervisor
K. Goddard, Compliance Specialist
Central Office (via email)
04-00740 Enforcement File

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

August 8, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source ID 204 Low Pressure (LP) Header System Visible Emissions Malfunction and Notice of Violation (NOV) Final Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this final (follow up) malfunction report to the Pennsylvania Department of Environmental Protection (PADEP) for visible emissions from the multipoint ground flare (MPGF) [1] on June 23, 2022. This letter is also being sent in response to the NOV letter for visible emissions exceedance dated July 21, 2022.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  On June 23 a butene railcar was being offloaded to the butene storage vessel in order to fill it prior to facility startup. At 13:30, following line-purging with nitrogen, this railcar was being depressured to the LP Header System. Butene remaining in this railcar was heard flowing out through the line and action was taken to close the valve and re-isolate the railcar. At 13:32 the continuous vent thermal oxidizer (CVTO)[2] tripped offline due to a high temperature spike in the combustion zone. Vent gas was rerouted to the MPGF.

  At 13:35 visible emissions were observed at the MPGF coming up over the heat shield wall in a generally south-southwest direction towards the interior of the facility. Visible emissions were black and nearly continuous for approximately 11 minutes until 13:46. Corrective action included Operations taking manual control of the MPGF assist air fans and increasing fan speed to eliminate the visible emissions.

  At 13:45 the CVTO burner was restored and began ramping up temperature to reach the minimum setpoint before switching back over to the CVTO. Setpoint temperature was reached on June 24 at ~3:35 at which time vent gas flow was switched back to the

[1] Identified as the LP Multipoint Ground Flare (MPGF), Control ID C204B in PA-04-00740C, and part of the LP Header System.
[2] Identified as the LP Incinerator, Control ID C204A in PA-04-00740C, and part of the LP Header System.

CVTO and the MPGF was isolated.

- **Cause and Corrective actions**
  Cause 1 (Air Assist Fan) – The MPGF air assist blower did not provide sufficient perimeter air to prevent visible emissions.

  Cause 1 Corrective Action(s) – Operations was notified of visible emissions from the MPGF within minutes from on the ground observations, and monitored from cameras displaying in the control room. Quick action by the console operator to take manual control of the blower and increase speed minimized the duration of visible emissions from the MPGF. Communications and work processes functioned as-intended to take corrective actions in a timely manner.

  MPGF blower speed control has been updated with smooth ramping from minimum speed to maximum speed. The speed setpoint is still based on flare flow and net heating value and follows the curve provided by the flare vendor. However, the discrete steps have been removed and replaced with continuous speed control. Two additional handles have been added - gain and bias. The speed setpoint is referenced from the curve and then calculated as (referenced_speed) * (gain) + (bias). These long term improvements will increase the blower responsiveness and reduce the likelihood of future visible emissions from incidents.

  Cause 2 (Butene Railcar Depressure) – The butene railcar was not empty when it was depressured to the LP Header System. Multiple trips of the unloading sequence after sustained unloading of butene led Operations to believe the unload was complete and the railcar was empty. DCS trends have been analyzed and confirmed that multiple trips of the unloading sequence were caused by a flow transmitter. A five-second bad signal / trip delay had been implemented but all trips occurred after five seconds elapsed.

  Cause 2 Corrective Action – The operations team unloading the railcar quickly identified an abnormal situation upon depressurizing the railcar which was not empty and took action to manually close the valve, and re-isolate the railcar. This minimized the amount of butene sent to the MPGF and minimized duration and impact of the event.

  The flow transmitter has been evaluated and time delay on the trip for the unloading sequence has been extended from five (5) to sixty (60) seconds . Multiple butene unloading sequences have been completed since this event without incident.

  Unload procedures have been reviewed and updated to include:
  - Criteria for determining if a railcar is ‘empty’ (e.g. density, totalizer, flowrate, etc.)
  - Additional steps for de-pressuring a railcar that is suspected to have a residual heel (e.g. cracking the valve, continuous comms with console for feedback on temp, etc.)
  - A precaution in the procedure regarding what is meant by “slowly” opening the flow / “cracking” open the valve for de-pressuring a railcar post-unload.

- **Time when the incident was first observed, and duration of excess emissions**
  June 23, 2022 at 13:35 for 11 minutes until 13:46 for visible emissions, and for 14 hours

until June 24 at 3:35 for use of the MPGF until the CVTO was restored.

- **Final emissions and calculations (See Attachment 1)**

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Fabrizi, District Supervisor

Attachment 1 - Emission Calculations				
Emission Unit(s) ID	=	***204, C204B***		***Multipoint Ground Flare***
Parameter		***Value***		***Source / Basis***
Calculation Inputs:				
Heat Input [HHV]	=	150.9	MMBtu	Measured and calculated heat input June 23 13:30 to June 24 03:35
Material Flow	=	5903.1	lbs	Measured and calculated total input June 23 13:30 to June 24 03:35
CH4 Input	=	5033.8	lbs	Measured and calculated CH4 June 23 13:30 to June 24 03:35
C3- VOC Input	=	14.5	lbs	Measured and calculated C3- VOC June 23 13:30 to June 24 03:35
C4+ VOC Input	=	894.5	lbs	Measured and calculated C4+ VOC June 23 13:30 to June 24 03:35
Carbon %	=	74.1	wt %	Measured carbon content June 23 13:30 to June 24 03:35
Sulfur %	=	0.0000	wt %	Measured sulfur content June 23 13:30 to June 24 03:35
PM (filterable) EF	=	0.0019	lb/MMBtu	AP-42, 1.4-2 (filterable only)
PM10 EF	=	0.0075	lb/MMBtu	AP-42, 1.4-2
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, 1.4-2
C3- DRE	=	99.00000	%	Light hydrocarbon destruction efficiency consistent with TCEQ guidance
C4+ DRE	=	98.00000	%	Heavy hydrocarbon destruction efficiency consistent with TCEQ guidance
NOx EF	=	0.06800	lb/MMBtu	AP-42, 13.5-1
CO EF	=	0.31000	lb/MMBtu	AP-42, 13.5-2
N2O EF	=	1.3E-03	lb/MMBtu	40 CFR 98, Table C-2; EF for fuel gas.
H2SO4 Ratio	=	4.0E-02	SO3/SO2	AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
HAP EF	=	1.9E-03	lb/MMBtu	AP-42, 1.4-3
MW C	=	1.2E+01	lb/lb-mol	Constant
MW CO2	=	4.4E+01	lb/lb-mol	Constant
MW S	=	3.2E+01	lb/lb-mol	Constant
MW SO2	=	6.4E+01	lb/lb-mol	Constant
Total Hours	=	14	hr	June 23 13:30 to June 24 03:35
Emissions Calculations:				
PM (filterable) Emissions	=	0.28	lb	= (Heat Input [HHV]) x (PM (filterable) EF)
PM10 Emissions	=	1.12	lb	= (Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	1.12	lb	= (Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	18.04	lb	= (C3- VOC Input) x (100 - C3- DRE)/100 + (C4+ VOC Input) x (100 - C4+ DRE)/100
NOx Emissions	=	10.3	lb	= (Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.00	lb	= (Material Flow) x (Sulfur %) x (MW SO2) / (MW S)
CO Emissions	=	46.8	lb	= (Heat Input [HHV]) x (CO EF)
CO2 Emissions	=	16,038	lb	= (Material Flow) x (Carbon %) x (MW CO2) / (MW C)
N2O Emissions	=	0.20	lb	= (Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	50.34	lb	= (CH4 Input) x (100 - C3- DRE)/100
H2SO4 Emissions	=	0.00	lb	= (SO2 Emissions) x (H2SO4 Ratio)
HAP Emissions	=	0.28	lb	= (Heat Input [HHV]) x (HAP EF)
CO2e Emissions	=	17,356	lb	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.

2700-FM-AQ0023 Rev. 1/2008

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

INSPECTION REPORT

Commonwealth of Pennsylvania
Department of Environmental Protection
Air Quality Program

Date(s) of Inspecti	TV ☐ PA ☐ SM ☐ GP ☐ NM ☐ MEGA ☒	Permit #(s):	Expiration Date:	Case #:	PF ID #:
7/20/22		PA-04-00740A, B, C		04-00740	775836

Company Name:	Municipality:	County:
Shell Chemical Appalachia LLC	Potter Township	Beaver

Plant Name:	Physical Location:	Federal ID — Plant Code #:
	Route 18	46-1624986-1

Responsible Official:	Mailing Address:
William Watson	300 Frankfort Road
Title: General Manager	Monaca, PA 15061-2210
Phone #(s): 724-709-2825	

Mark (X) All Inspection Types That Apply To This Inspection:

☐	Full Compliance Evaluation (FCE)	☐	Plan Approval Inspection	☒	File Review (FR)
☐	Operating Permit Inspection (PI)	☐	Initial Permit Inspection (IPI)	☐	Complaint Inspection (CI)
☐	Routine/Partial (RTPT)	☐	Follow-Up Inspection (Ref. Date:_____)	☐	Sample Collection (SC)
☐	Minor Source(s) Inspection (RFD)	☐	Stack Test Observation	☐	Multi-Media Inspection (MM)
☐	Other:	☐	Announced		

Annual Compliance Certification Received: ☐ YES ☐ NO ☒ N/A	Date Received:
AIMS Report Received: ☐ YES ☐ NO ☒ N/A	Date Received:

Mark (X) All Activities That Apply:

☒	File Review	☐	Pre-Inspection Briefing	☐	Exit Interview/Briefing
☐	Pre-Inspection Observations	☐	Check For New/Unreported Sources	☐	Sample(s) Collected
☐	Visible Emissions Observations	☐	Verify Operation of CEMS	☐	Other

Compliance Status: ☐ In ☒ Out ☐ Pending ☐ Awaiting Co. Report **Needs a Follow-Up Inspection?** ☐ Yes ☒ No

SIC: 2821 NAICS: 221112

The Department received a malfunction report from Shell Chemical Appalachia LLC on 6/30/22. The report indicated that on 6/23/22 approximately 11 minutes of Visible emissions were observed from the multipoint ground flare (MPGF) during the offloading of a butane railcar. The Department has identified the following violations from this event:

1. PA-04-00740C, Section D, Source 204, Condition #001, states visible emissions from both the LP incinerator and MPGF shall not exceed 0% except for a total of five minutes during any consecutive two-hour period. By permitting visible emissions greater than 0% opacity from the MPGF in excess of five minutes on June 23, 2022, Shell caused violations of PA-04-00740C and 25 Pa. Code § 127.25.

2. 40 CFR § 60.18 (b)(1), states flares shall be designed for and operated with no visible emissions as determined by the methods specified in paragraph (f), except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. By permitting these visible emissions from the MPGF on June 23, 2022, Shell caused a violation of 40 CFR § 60.18.

Company Representative:	Title:	Signature:	Date:
MEMO TO FILE			
DEP Representative:	Title:	Signature:	Date/Time:
Scott Beaudway	Air Quality Specialist	Scott Beaudway/SB	7/20/22

This document is official notification that a representative of the Department of Environmental Protection, Air Quality Program, inspected the identified site. The findings of this inspection are shown above and on any attached pages, and may include violations uncovered during the inspection. Violations may also be discovered upon review of sample results or from any additional review of Department records. Notification will be forthcoming, if such violations are noted.

 eFacts Inspection ID#: 3394025 Date: 7/20/22 Reviewed By _____

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

June 30, 2022

Mark Gorog P.E., Regional Manager Air Quality
Program Pennsylvania Department of Environmental
Protection Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Source ID 204 Low Pressure (LP) Header System Visible Emissions Malfunction Report, June 23, 2022

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this malfunction report to the Pennsylvania Department of Environmental Protection (PADEP).

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  On June 23 a butene railcar was being offloaded to the butene storage vessel in order to fill it prior to facility startup. At 13:30, following line-purging with nitrogen, this railcar was being depressured to the LP Header System. Butene remaining in this railcar was heard flowing out through the line and action was taken to close the valve and re-isolate the railcar. At 13:32 the continuous vent thermal oxidizer (CVTO)[1] tripped offline due to a high temperature spike in the combustion zone. Vent gas was rerouted to the multipoint ground flare (MPGF)[2].

  At 13:35 visible emissions were observed at the MPGF coming up over the heat shield wall in a generally south-southwest direction towards the interior of the facility. Visible emissions were black and nearly continuous for approximately 11 minutes until 13:46. Corrective action included Operations taking manual control of the MPGF assist air fans and increasing fan speed to eliminate the visible emissions.

  At 13:45 the CVTO burner was restored and began ramping up temperature to reach the minimum setpoint before switching back over to the CVTO. Setpoint temperature was reached on June 24 at ~3:35 at which time vent gas flow was switched back to the CVTO and the MPGF was isolated.

[1] Identified as the LP Incinerator, Control ID C204A in PA-04-00740C, and part of the LP Header System.
[2] Identified as the LP Multipoint Ground Flare (MPGF), Control ID C204B in PA-04-00740C, and part of the LP Header System.

Investigation into the event is ongoing for further details, cause, and corrective actions.

- **Time when the incident was first observed, and duration of excess emissions**
  June 23, 2022 at 13:35 for 11 minutes until 13:46 for visible emissions, and for 14 hours until June 24 at 3:35 for use of the MPGF until the CVTO was restored.

- **Estimated rate of excess emissions**
  Visible emissions > 0% for 11 miutes

Emissions Summary (total lbs/event)	
CO2e	17,426.3
CO2	16,108.4
Methane (CH4)	50.3
CO	46.8
NOx	10.3
N2O	0.2
SO2	0
PM (filterable)	0.3
PM (10/2.5)	1.1
VOC	18.0
HAP (Total)	0.3

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Scott Beaudway, Air Quality Specialist
Anna Fabrizi, District Supervisor

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City, State, ZIP+4® Harrisburg, Pennsylvania 17120

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Postage $4.14
Total Postage and Fees $11.64

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02/02/2023

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Street and Apt. No., or PO Box No. 1650 Arch Street (3PM52)
City, State, ZIP+4® Philadelphia, Pennsylvania 19103-2029

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $4.14
Total Postage and Fees $11.64

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7022 0410 0002 7619 7637

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Street and Apt. No., or PO Box No. 1200 Pennsylvania Ave NW (Mail Code 1101A)
City, State, ZIP+4® Washington, DC 20460

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City, State, ZIP+4® Houston, Texas 77079

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☐ Certified Mail Restricted Delivery $
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Postage
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Total Postage and Fees
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William Watson and [illegible] Karl
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300 Frankfort Road
City, State, ZIP+4®
Monaca, Pennsylvania 15061

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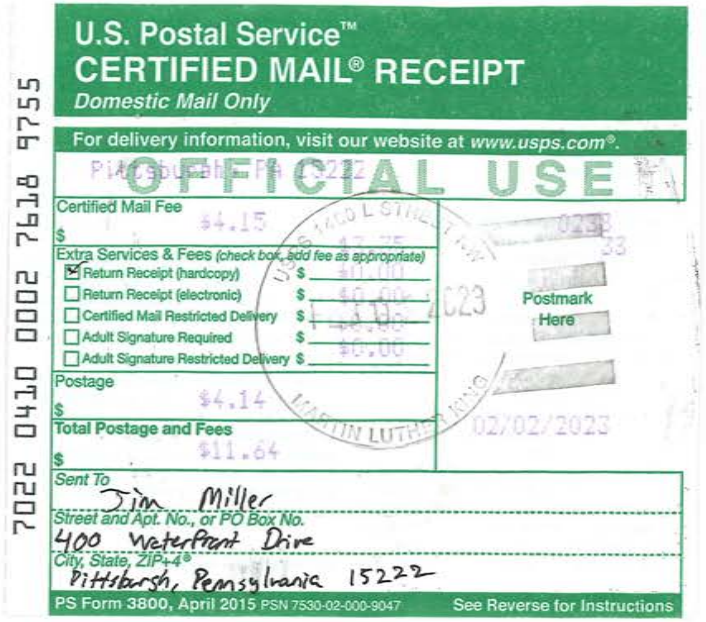
7022 0410 0002 7618 2930



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Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $

Postage
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Total Postage and Fees
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Jim Miller
Street and Apt. No., or PO Box No.
400 Waterfront Drive
City, State, ZIP+4®
Pittsburgh, Pennsylvania 15222

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